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January 1952

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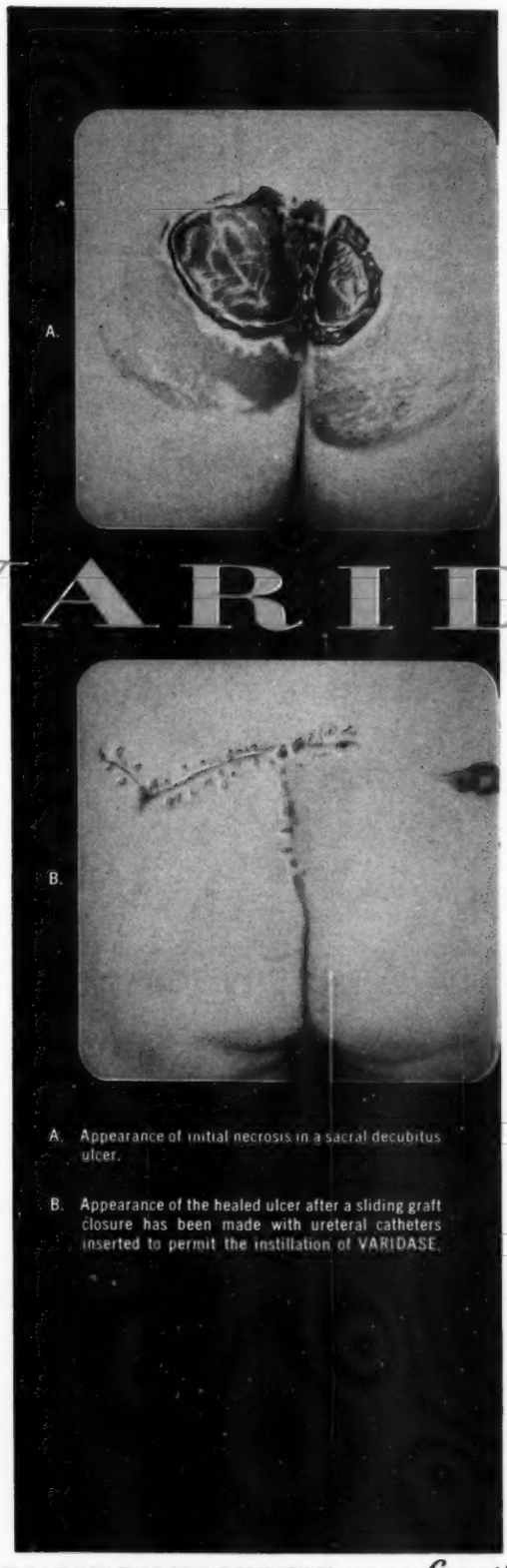

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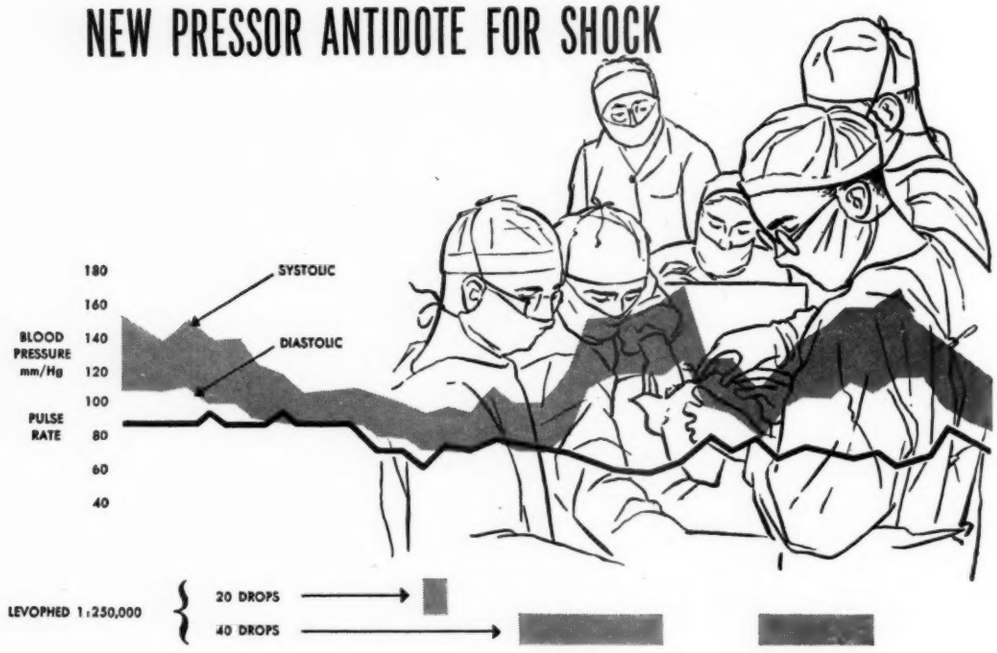

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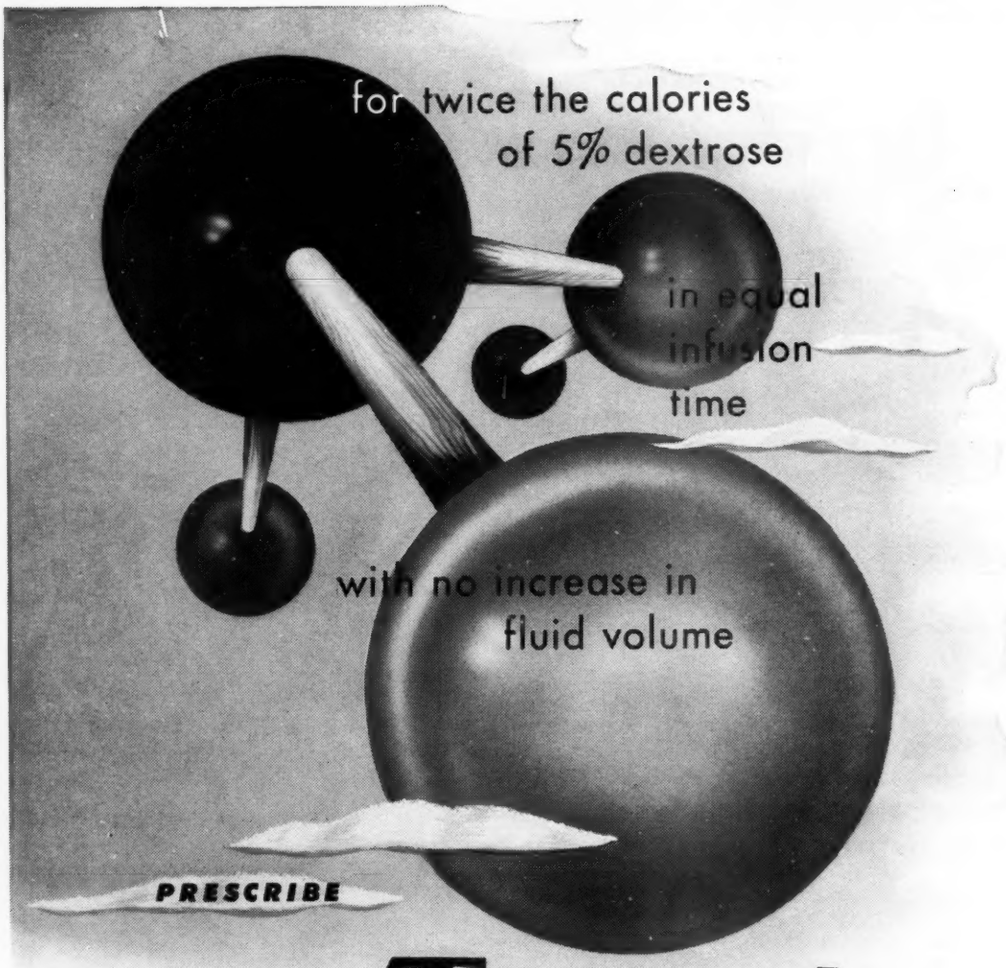

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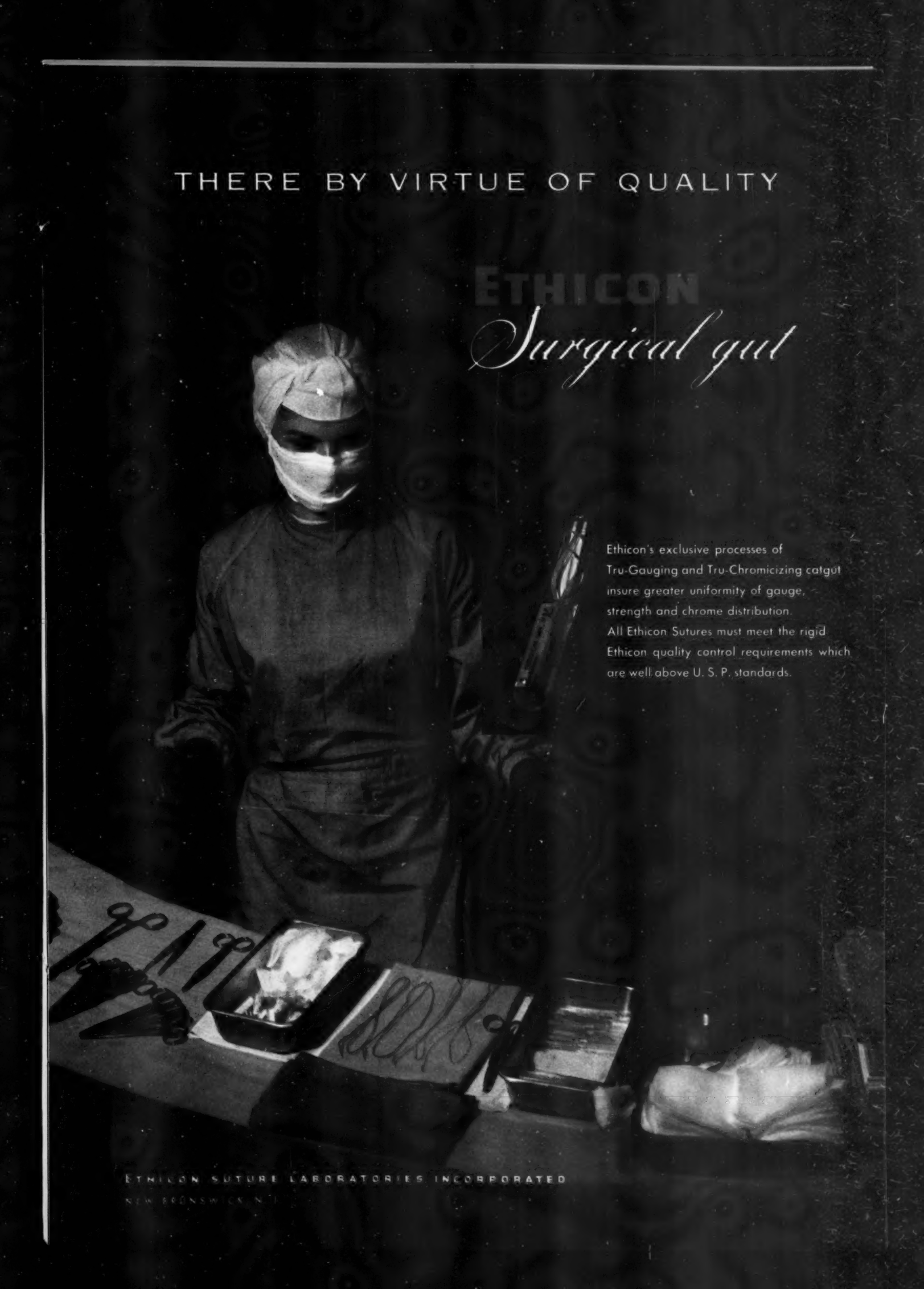
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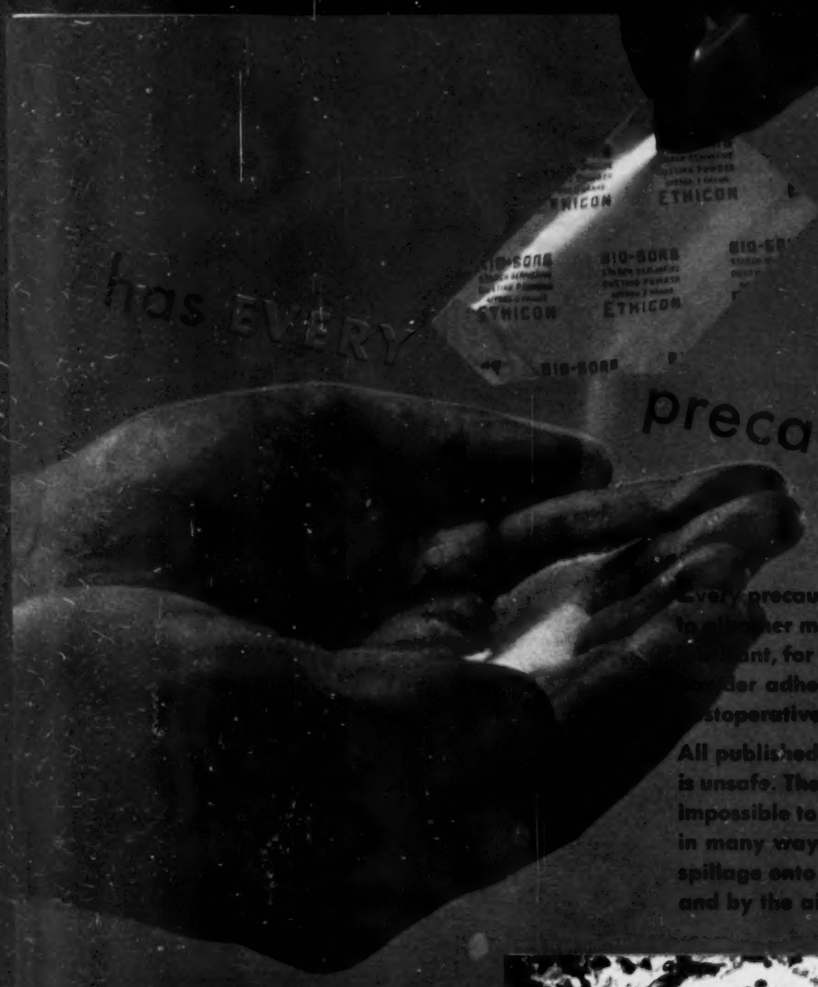

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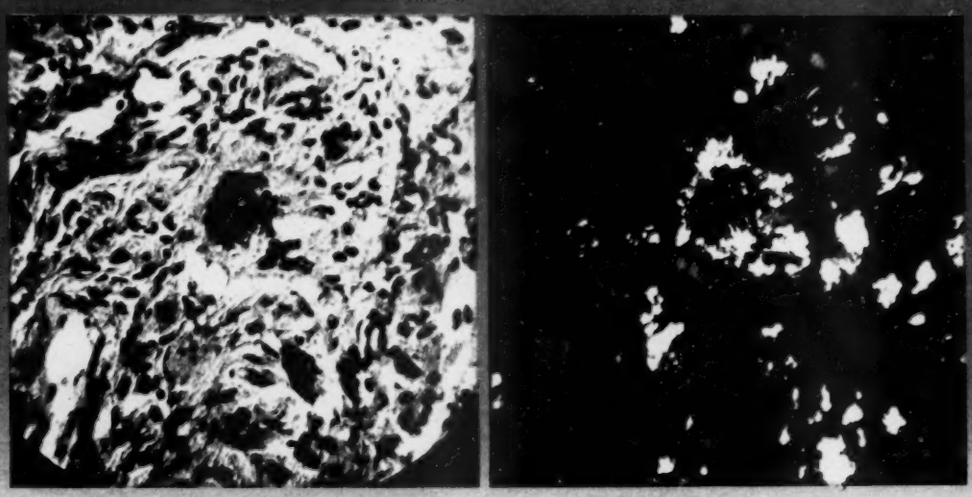

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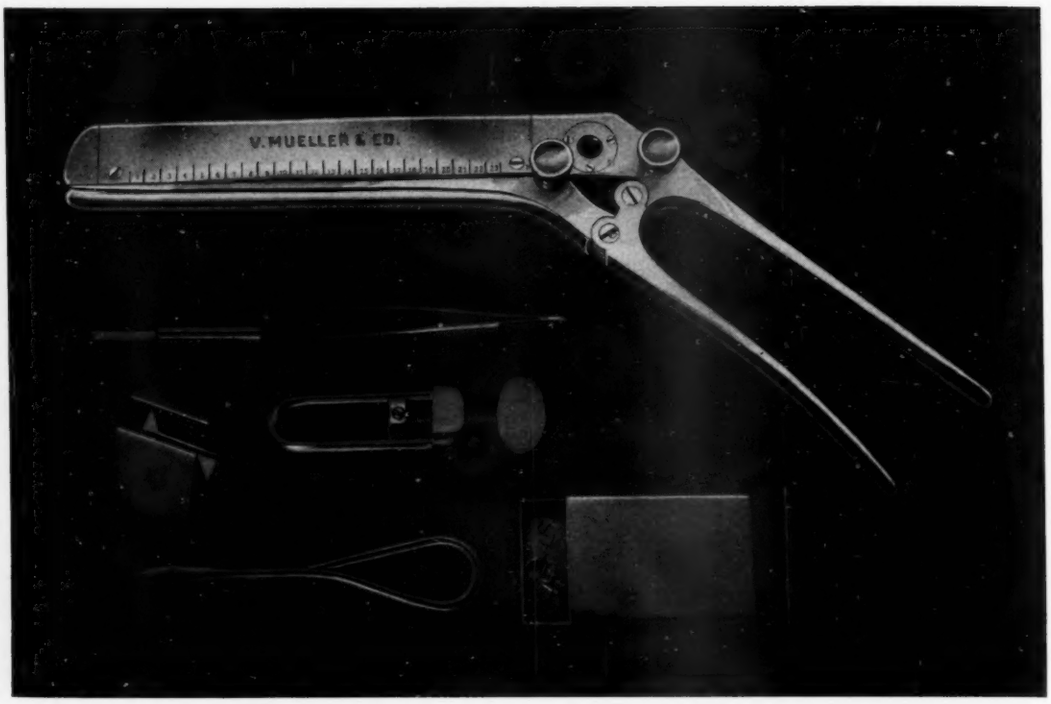

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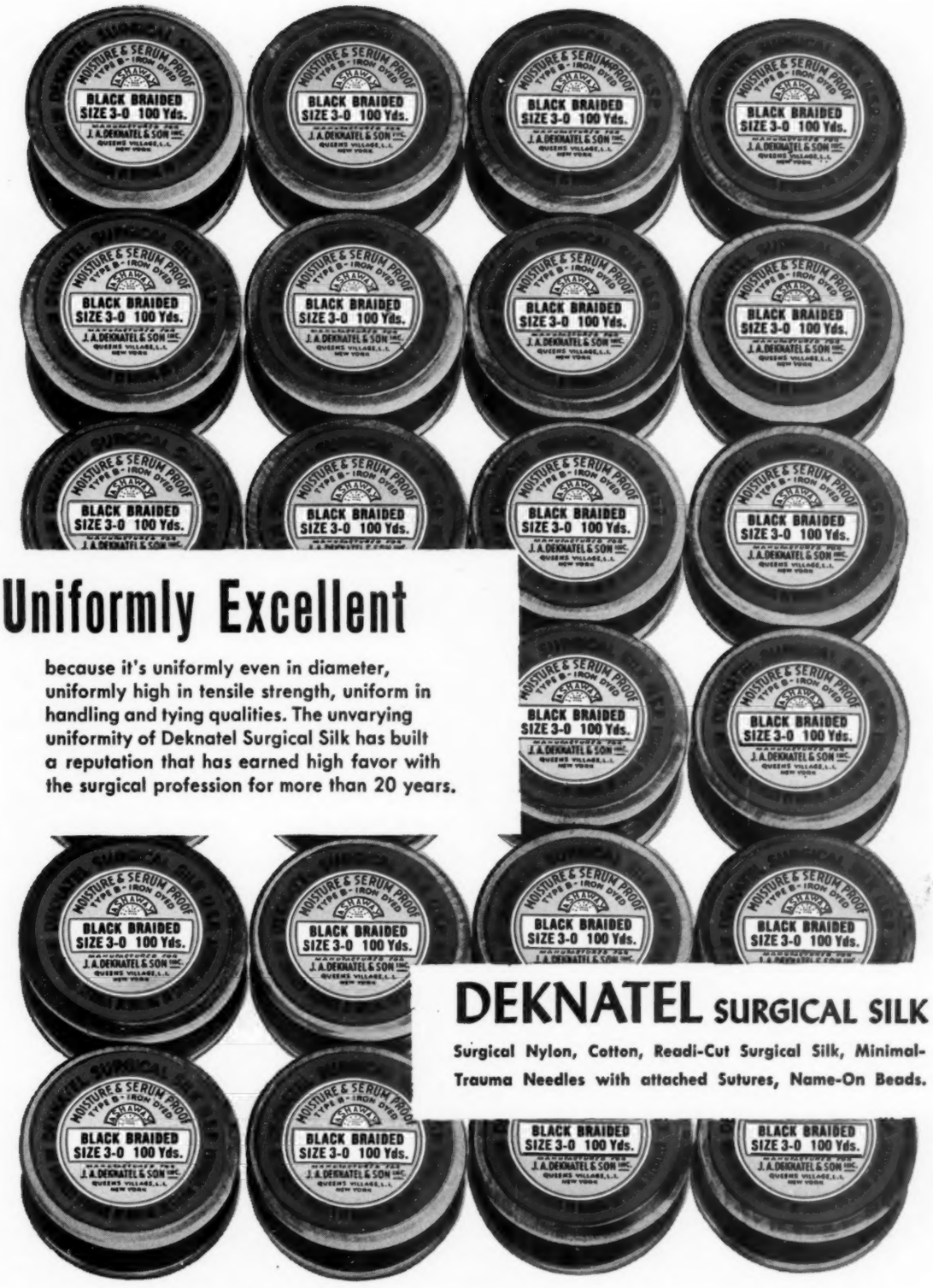

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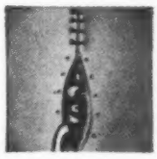

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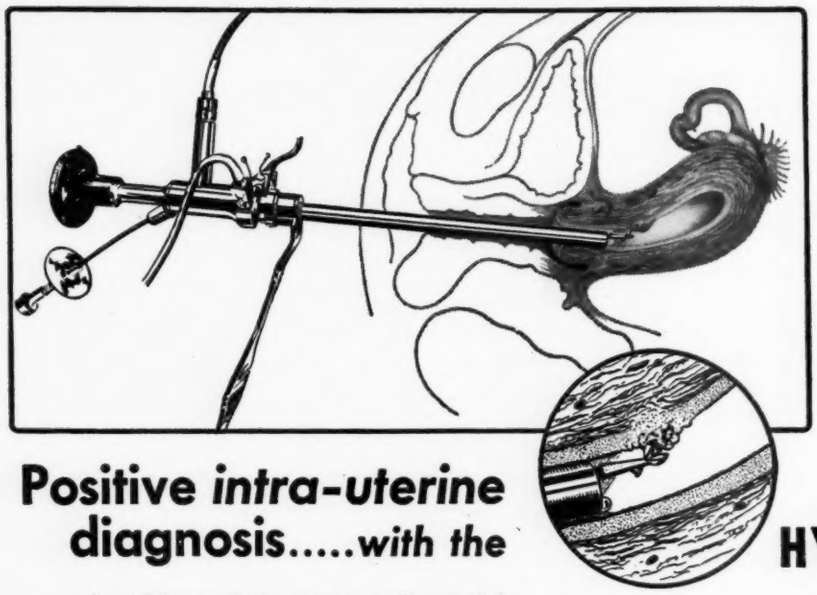

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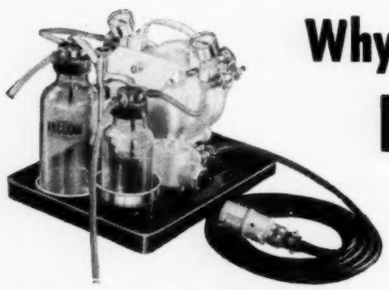

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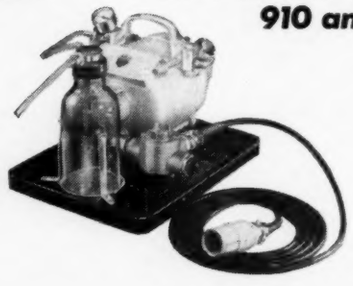

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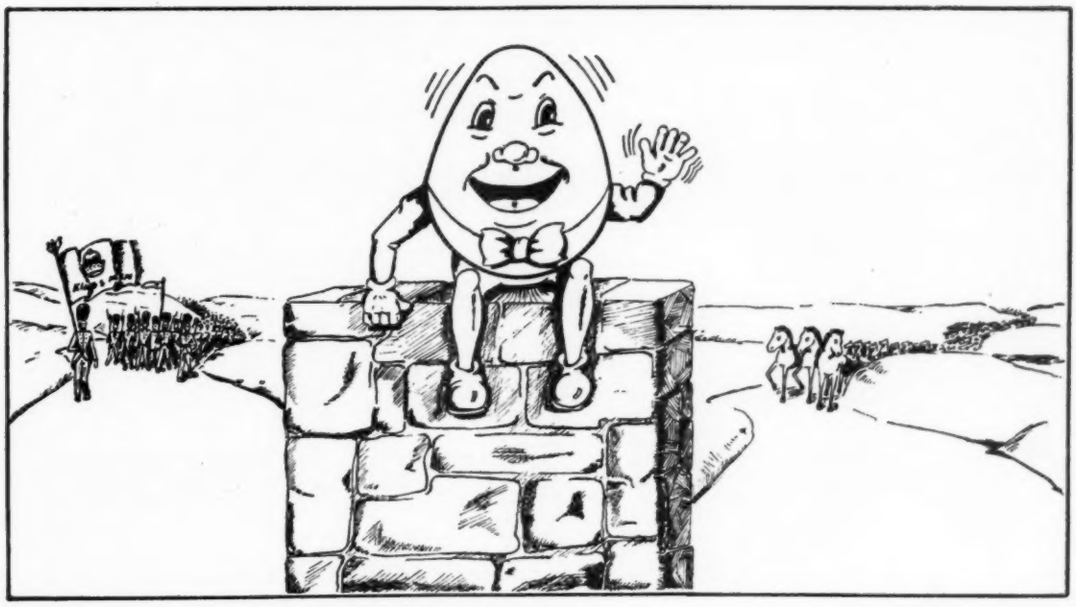

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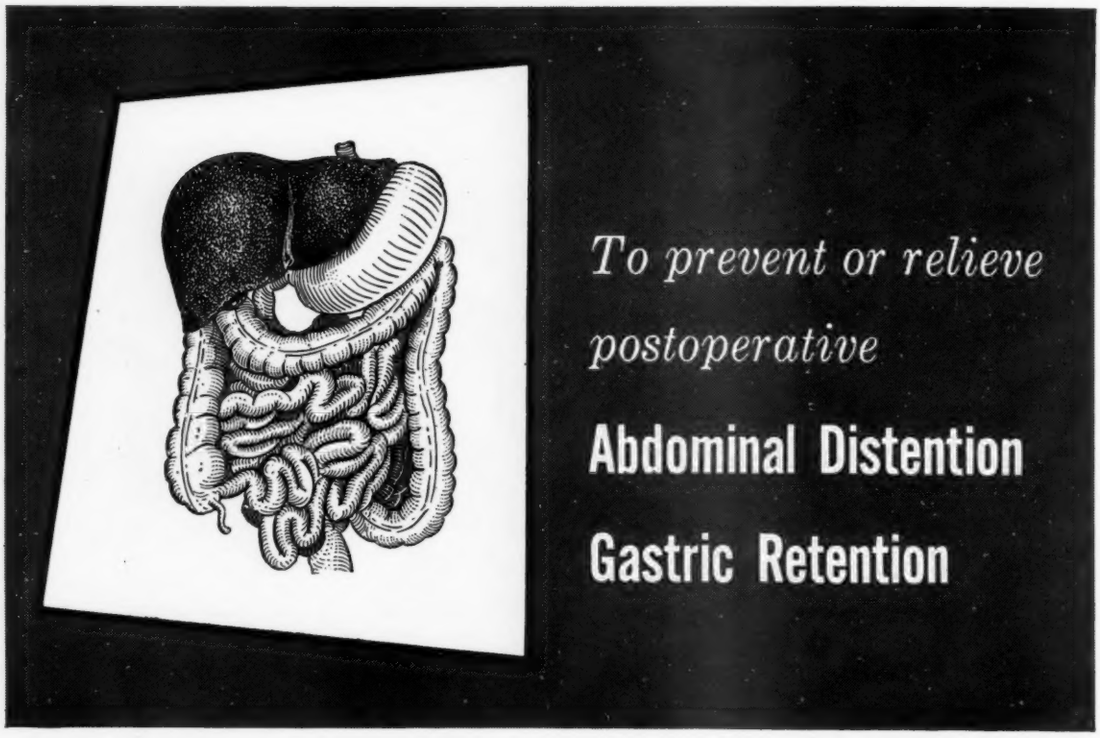

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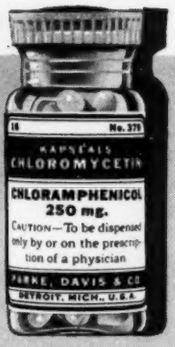

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*..... McCrumb, F. R., Jr., and others: Treatment of Hemophilus Influenzae Meningitis with Chloramphenicol and Other Antibiotics, J.A.M.A. *145*:469 (Feb. 17) 1951.

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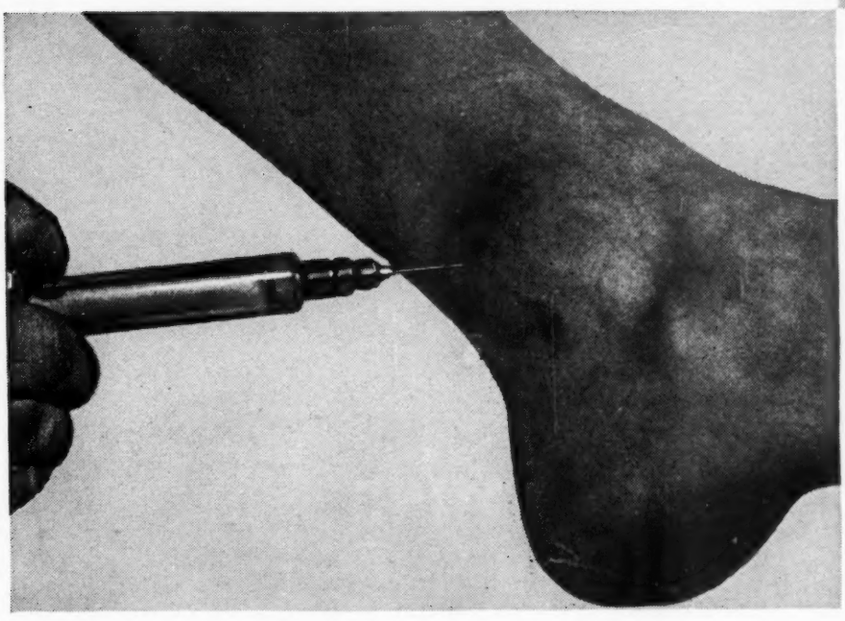

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1. Britton, R. and Habif, D. V.: To be published.

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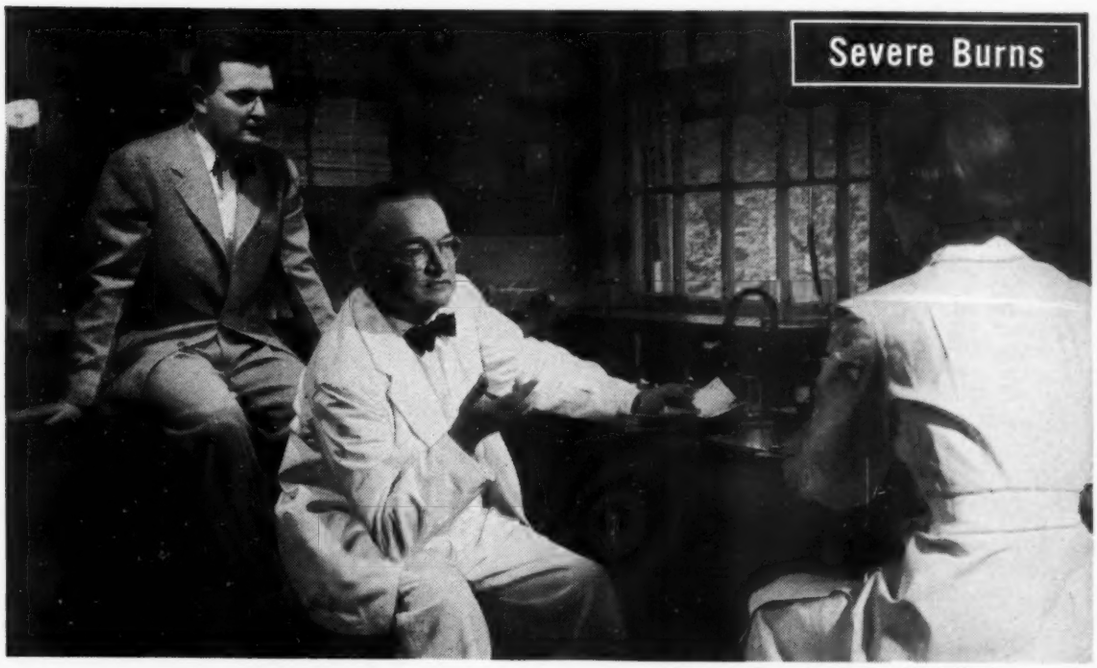

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*Whitelaw, M. J., J.A.M.A. *145:* 85, Jan. 13, 1951.

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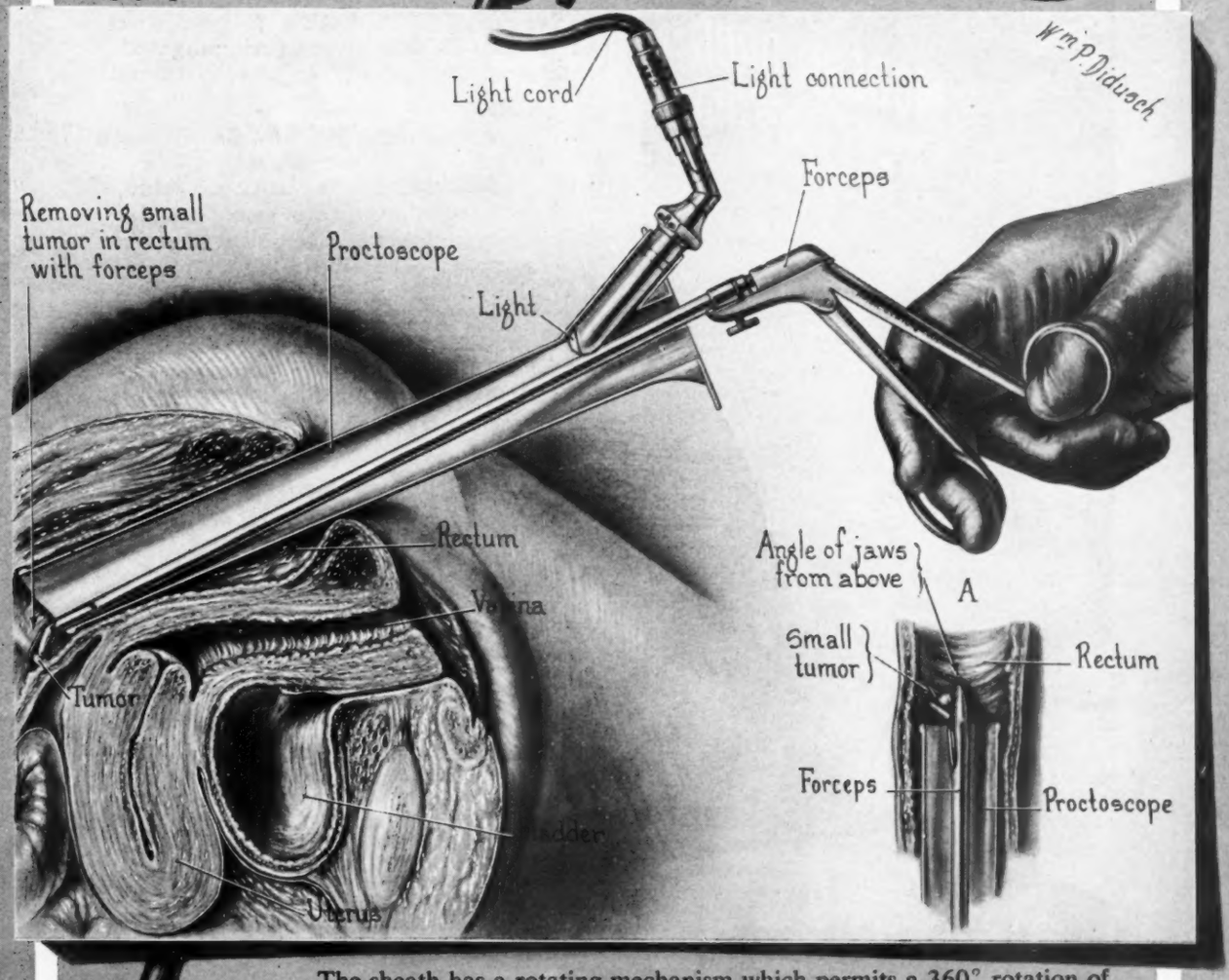

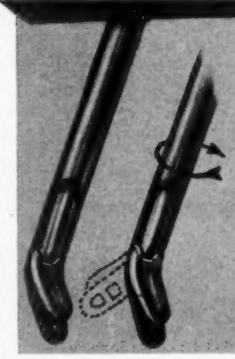

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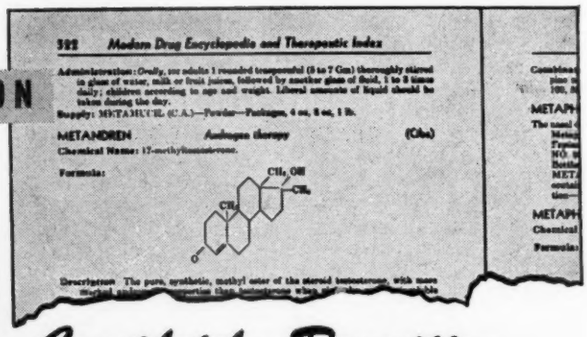
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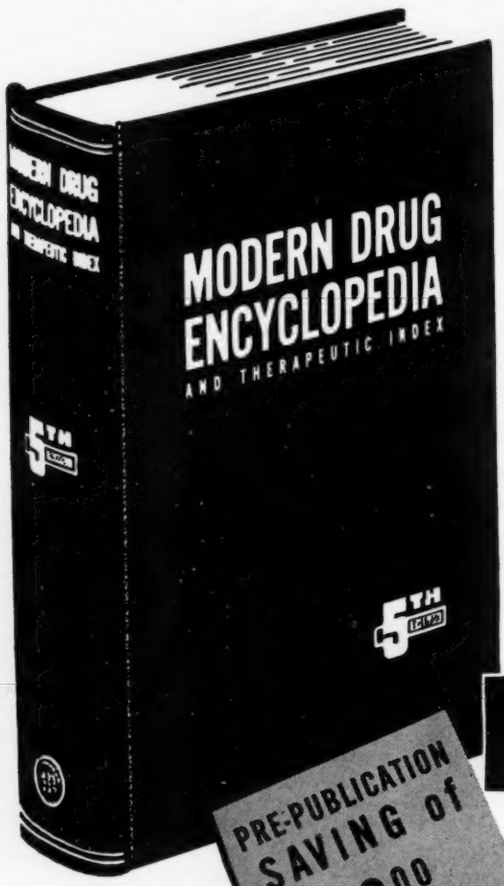

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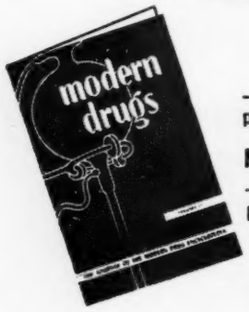

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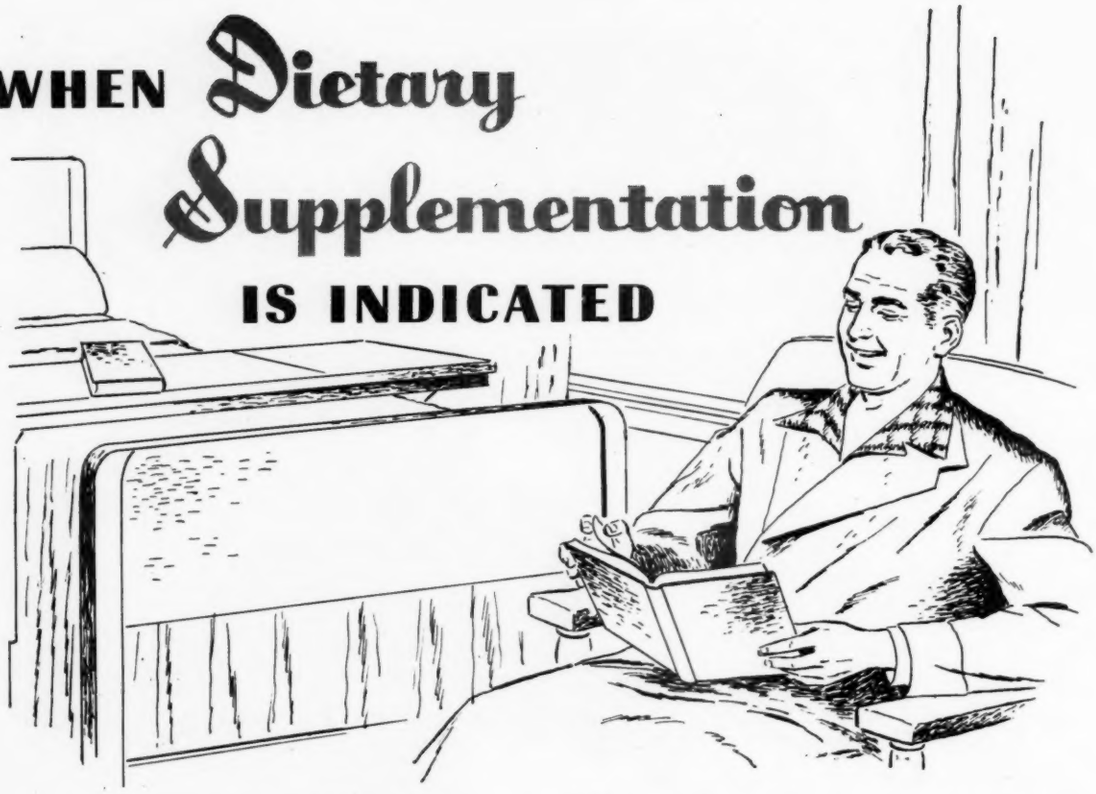

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1. Mann, G. V., and Stare, F. J.: Nutritional Needs in Illness and Disease, in Handbook of Nutrition, ed. 2, published for American Medical Association, Philadelphia, The Blakiston Company, 1951, chap. 17, p. 351.

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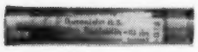

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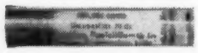

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VOL. LXXXIII JANUARY, 1952 NUMBER ONE

Editorial

HYPOTENSIVE ANESTHESIA

THE surgeon ordinarily associates a fall in blood pressure during operation with the development of surgical or traumatic shock and his first reaction is to push measures to elevate the blood pressure to normal or near normal levels. While part of the picture of hemorrhagic shock is hypotension, the converse is certainly not true, i.e., hypotension in the patient undergoing operation may not indicate, under certain circumstances, surgical shock.

A hypotensive state resulting from loss of blood or plasma to the exterior or into the tissues and associated with vasoconstriction which shortly results in tissue anoxia is indeed a dangerous situation. A hypotensive state existing where there has not been escape of blood outside of the circulation and associated with widespread dilation of arterioles and capillaries is not a dangerous situation and is one in which tissue anoxia does not readily supervene. In 1944 Phemister demonstrated in rabbits that the reduction in blood pressure to shock levels by stimulation of the aortic-depressor nerve could be well tolerated for hours and that recovery was prompt when the stimulation was removed, whereas reduction in blood pressure to comparable shock levels due to bleeding of the animal was not easily or at all recovered from. These experiments served to emphasize the differences from the standpoint of danger to the organism between hypotension due to a neurogenic mechanism (relatively innocuous) and hypotension resulting from severe hemorrhage.

The control of bleeding from the operative area is one of the most important features in surgery. The reduction in bleeding from areas of surgical intervention that occurs when the patient's blood pressure falls is a phenomenon that experienced surgeons are well acquainted with, but one which does not contribute to his peace of mind since under usual circumstances it indicates that the patient has gone into shock. It would seem that if a controlled and non-dangerous hypotensive state could be induced prior to operation the blood loss from the operative area would be significantly reduced.

In 1946 Gardiner of Cleveland, Ohio, reported just such an attempt in a patient from whom he removed a meningioma of the olfactory groove. The plan for induction of hypotension was to remove from the dorsalis pedis artery 1,600 cc. of blood. When this was carried out, the systolic pressure dropped from 140 to 100 mm. Hg. After completion of the operation 1,100 cc. of this blood were reinfused intra-arterially. It was this author's opinion that the induced hypotensive state greatly facilitated the operation.

Another means of achieving a hypotensive state satisfactory for operative procedures is by high spinal block to involve the whole sympathetic outflow and, added to this, proper positioning of the patient to permit blood pooling in the lower extremities and other depending parts away from the operative site. According to Gillies of Edinburgh, "A low head of arterial pressure associated with vaso-

dilation and a normal blood volume carries less potential danger than the illusory higher pressure which accompanies vasoconstriction and a reduced blood volume."

In the years 1948 to 1951 reports have appeared in the British literature on the pharmacologic and physiologic action of certain methonium compounds which were observed to cause sympathetic nerve paralysis by ganglionic block. Not only were these drugs used to treat hypertension, but also Enderby in 1950 reported upon their use in conjunction with proper posturing of the patient to afford a hypotensive state during operation that would significantly reduce bleeding from the operative field. Recently a number of similar reports by others have appeared in the British literature.

In connection with radical surgical procedures for cancer the possibilities for reducing hemorrhage and otherwise facilitating the operation were very appealing to the writer. Dr. Paul Boyan, of the Anesthesiological Service of the Memorial Hospital, New York City, took advantage of the sympathetic blocking property of hexamethonium-bromide, and combining this with postural ischemia and pentothal-curare-ether endotracheal anesthesia was able to produce satisfactorily a controlled hypotensive state. In all, the writer has operated upon thirty patients under hypotensive anesthesia and these were more or less selected for gravity of procedure under conditions in which ordinarily there would be appreciable blood loss. These procedures included pancreatoduodenectomy, radical panhysterectomy with pelvic lymph node dissection, total pelvic exenteration and so forth. In all instances there was no question on the part of the writer and members of his teams that blood loss was appreciably reduced. To cite concrete evidence for this, in an instance of pancreatoduodenectomy the specimen, i.e., lower stomach, duodenum and head of the pancreas, was excised in the course of slightly more than thirty minutes; in another instance of total pelvis extenteration the specimen was out in forty-eight minutes; in still another instance (huge carcinoma of the rectosigmoid involving small bowel, urinary bladder and uterus) the tumor, segment of sigmoid, segment of ileum and over half the bladder, with lower abdominal retroperitoneal node excision, were excised in fifty minutes. These "operating times" are the result not of rapid manual activity or special dexterity, because actually the manual maneuvers were conducted relatively slowly, but of the marked reduction in the tendency of the tissues to bleed. Indeed the situation suggested dissection upon a fresh cadaver. Not only is blood loss reduced, but also concomitantly the tissues are more exactly dissected, principle blood vessels more easily and cleanly visualized for isolation and ligation, and insofar as cancer surgery is concerned, areolar tissues and lymph nodes are dissected *en bloc* in a more satisfying manner than is the case under ordinary anesthesia at usual blood pressure levels. Detailed reports of the experience in these cases are in preparation for publication.

Much more needs to be learned concerning anesthesia in the induced hypotensive state but from a limited but very poignant experience the writer believed that this may prove to be one of the most important developments in the refinement of operative technic for complicated surgical procedures that has been made in recent years.

ALEXANDER BRUNSCHWIG, M.D.

Original Articles

BRANCHIAL CYSTS AND FISTULAS*

A STUDY OF SEVENTY-FIVE CASES RELATIVE TO CLINICAL ASPECTS AND TREATMENT

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BRANCHIAL cysts and fistulas are so named because of their supposed embryologic derivation from the branchial arches. Although this explanation of their origin has been handed down in the literature and texts for many years, there is not a great deal of evidence to support this hypothesis. This lack of evidence has been repeatedly pointed out by Bailey,[1,2] Meyer[3] and more recently by King.[4] In 1912 Wenglowski[5] reinvestigated the problem and concluded that branchial cysts arose from the remnants of the thymic duct. This theory, also, has been reputed by many as untenable. In the absence of a satisfactory, undisputed theory to explain the embryologic derivation of these tumors and fistulas many plead for a change in terminology. They believe that it would be better to name these cysts according to their anatomic position or pathologic entity, such as, lateral cervical cysts of the neck or lateral lympho-epithelial cysts of the neck.[4] It is not the purpose of this paper to discuss at any great length the possible embryologic development of branchial cysts and fistulas. For this purpose the reader is referred to the excellent discussions by Bailey,[1,2] Meyer[3] and King.[4] Suffice to say, we believe that the long time usage of the terms "branchial cysts and fistulas" makes them permanent in our literature.

The present series of seventy-five patients includes sixteen patients with branchial fistulas and fifty-nine patients with branchial cleft cysts. These two conditions are considered separately because of significant differences in the history and objective findings. Because of these differences it is thought that in many if not most instances these conditions are not merely different manifestations of a common underlying developmental defect. Differences in presenting location, age of onset, ability to trace the tract to the pharynx and microscopic findings are important in attempting to decide this question. It is true that on occasion perhaps some cysts are incomplete fistulas without external openings. Undoubtedly, some such cysts remain undetected early in life and are recognized only after spontaneous rupture, with the formation of a sinus. Such cases are classified as branchial fistulas. In view of this, we believe that relative to diagnosis and treatment it is easier to think of branchial fistulas and cysts as two distinct entities.

BRANCHIAL FISTULAS

Of the sixteen patients with branchial fistulas there were six males and ten females. The age of the patients when the sinus opening was first noticed varied from birth to fifteen years, with the largest number (seven) first noticed at birth. In only two instances was the age stated definitely as being over five years. One patient, a forty-one year old man, first noticed a draining sinus at the age of ten, and the other, a girl of fifteen, had a fistula since birth, with a second one developing when she was fourteen years old. The age of the patients when first examined ranged from seven to forty-one years; the average age was eighteen years.

There were no differences in the location of the sinus relative to right or left; there were six on the right, six on the left and four bilateral. Of the twenty sinus tracts studied (twelve unilateral plus four bilateral) the presenting location of the external opening was in

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FIG. 1. Typical branchial fistula in a young boy. The fistula can be seen as a small dark area at the anterior border of the left sternocleidomastoid muscle in the lower third of the neck.

most cases in close association with the anterior border of the sternocleidomastoid muscle. (Fig. 1.) Eight sinuses were anterior to the sternocleidomastoid muscle in the lower third of the neck, eight in the middle third of the neck and one in the upper third of the neck. Two sinuses were situated in the suprasternal notch and one was below the manubrium.

In only one case was a family history elicited. This was a twenty-five year old woman with bilateral fistulas whose father and cousin had similar sinuses in the neck.

Symptoms and Diagnosis. The branchial fistulas were first noticed as small dimples or pinpoint-sized openings in the lateral cervical region of the neck. (Fig. 1.) Some exuded a small amount of secretion whereas others discharged no secretions. Eight patients noted pain preoperatively and it is evident from these histories that the pain was secondary to obstruction of the sinus. Six patients had incisions on several occasions to relieve these painful obstructions. Two patients stated the sinuses drained more when they had a cold or upper respiratory infection. A correct diagnosis was made in all cases. The only other common diagnosis that is thought of, relative to a draining lateral cervical sinus, is tuberculous adenitis. A patient with cervical tuberculous adenitis may give a similar history of a swelling which became a draining sinus after incision and drainage. None of the patients had symptoms of vagus stimulation as in the case reported by Carp.[6]

Pathology. Of twelve specimens studied microscopically seven showed the sinus tract to be lined with stratified squamous epithelium, two with ciliated pseudostratified columnar epithelium and in three there was no evidence of epithelium. Only three specimens revealed lymphoid tissue. Other significant microscopic findings were fibrosis and chronic inflammation.

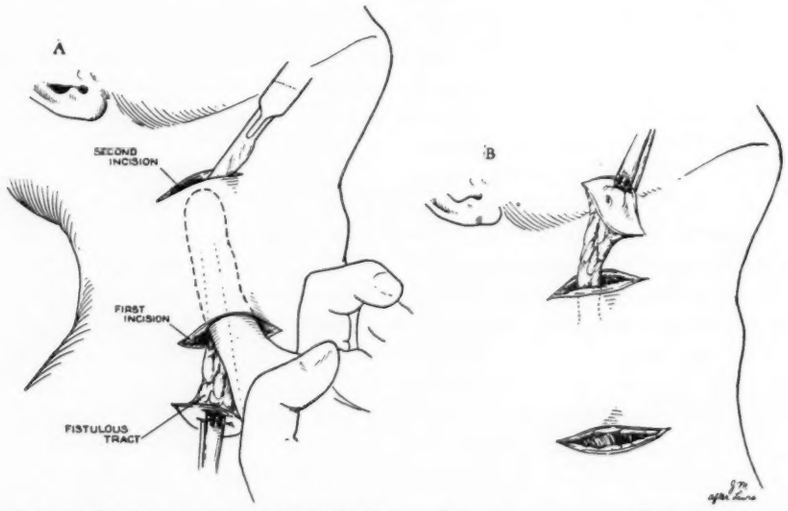

FIG. 2. Excision of branchial fistula. A, lower transverse elliptic incision excises sinus and allows dissection of fistulous tract from surrounding tissues; B, fistula is brought out through upper incision.

Operation. We believe branchial fistulas should be excised when discovered, except in the very young or in the presence of active

inflammation. In so doing an attempt is made to excise the entire tract from the external skin opening up to the entrance of the tract into the pharyngeal wall. The type of incision used in this series depended upon the location of the external opening and the length of the sinus tract. As most of the external orifices presented in the lower third of the neck, we used transverse multiple incisions in stepladder fashion (Fig. 2) in most cases. Occasionally, if the opening was in the middle or upper third, especially in short-necked individuals, one transverse incision sufficed. In a few cases, because of the length of the fistulous tract and surrounding induration, it was necessary to use a long longitudinal incision to obtain the necessary adequate exposure.

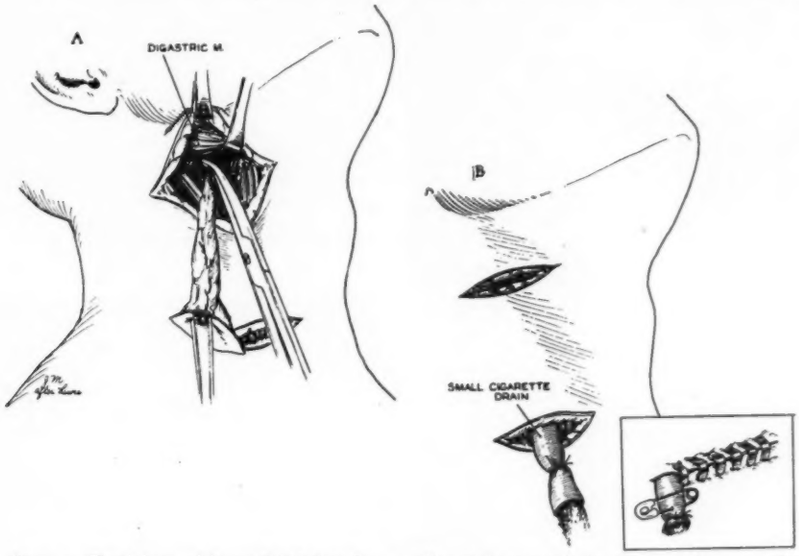

FIG. 3. Excision of branchial fistula. A, digastric muscle is retracted upward; fistula is separated from surrounding structures and ligated close to wall of pharynx. B, drain is inserted and wounds are closed with clips.

Regardless of the type of primary incision an elliptic incision is made around the orifice of the tract and the tract is meticulously dissected away from the surrounding structures. (Figs. 2 and 3.) As one dissects cephalad beneath the sternocleidomastoid muscle, care is taken to identify the internal jugular vein, the common carotid artery and the vagus nerve. The tract usually passes between internal and external carotid arteries. Above this level the hypoglossal nerve is isolated and preserved. (Fig. 4.) The posterior digastric muscle is retracted upward and the dissection is carried without difficulty to the wall of the pharynx. The tract is then ligated and excised close to the wall of the pharynx in the region of the tonsil, most often in the fossa of Rosenmüller. We do not routinely invert the divided stump into the pharynx.

Results and Complications. There was one recurrence two months following operation in a forty-one year old woman in whom further drainage developed. At the second operation

FIG. 4. Anatomy involved in excising branchial fistula and cyst; "O" indicates usual site of external sinus. Arrow shows frequent location of fistulous tract between internal and external carotid arteries.

5A 5B 5C 5D

FIG. 5. A, B and C, Typical branchial cysts in upper third and middle third of neck; D, atypical branchial cyst in lower third of neck extending beneath the sternocleidomastoid muscle into the posterior triangle.

the sinus was traced to the lateral pharyngeal wall and the patient has been free of symptoms since that time. This same patient suffered the only operative complication in this series, paralysis of the left vocal cord.

BRANCHIAL CYSTS

There were fifty-nine patients with branchial cysts, twenty-two males and thirty-seven females. The age of the patients when the cyst was first noticed varied from birth to sixty years. The greatest number (twenty-eight), however, occurred in patients between twenty-one and thirty years of age. This is in contrast to patients with branchial fistulas, the greatest number of whom were under five years of age. The average age at the time the patients were first examined was thirty-one years.

Thirty-six cysts were located on the right side and twenty-three on the left. The presenting location of branchial cysts as with branchial fistulas was in close relationship to the anterior border of the sternocleidomastoid muscle. Other locations for branchial cysts are as follows: anterior to the sternocleidomastoid muscle in the upper third, thirty-five, in the middle third, four, in the lower third, three; posterior to the sternocleidomastoid muscle in the upper third, three, in the lower third, one; along the entire extent of the sternocleidomastoid muscle, two; lateral to the sternocleidomastoid muscle, five; suprasternal notch, one; anterior to the sternocleidomastoid muscle, exact location unknown, three; location not definitely recorded, two. (Fig. 5.)

History and Symptoms. In only two of the fifty-nine patients was there a history of similar cysts in the immediate family. In ten cases there was a history of trauma which first brought the patient's attention to the cyst. Also, in ten cases history revealed an upper respiratory infection preceding the finding of the cyst. The patients all complained of a mass in the neck but only twenty-three of the fifty-nine had associated pain. There was great variation in the size of the cysts but in all cases it was noted that the mass increased in size very slowly. In one case the mass swelled with forced expiration. In seventeen cases there was a history of previous multiple incisions. Two patients had multiple aspirations. The duration of symptoms varied from six months to over ten years before the patients sought medical advice. The greatest number (thirty-four), however, came to the clinic within a year after first noticing the cyst.

Diagnosis. Whereas in all the cases of branchial fistulas the preoperative diagnosis was correct, in the cases of branchial cysts the preoperative diagnosis was made correctly in only thirty-three of the fifty-nine cases. The incorrect preoperative diagnoses are as follows: branchial cleft cysts and branchial cleft fistulas, one; metastatic cervical neoplasms, six; tuberculous adenitis, four; dermoid, one; lateral aberrant thyroid, one; adenoma of the thyroid, one; thyroglossal cyst, one; chylous cyst, one; cervical adenitis, two; deferred, one; several diagnoses but not a definite diagnosis, seven.

Relative to the diagnosis of branchial cysts it should be kept in mind that such cysts are always lateral cervical cysts, whereas thyroglossal cysts and dermoids are usually in the midline or close to the midline. Metastatic neoplasms should always be considered but on palpation they are usually harder and less discrete than branchial cysts. Furthermore, an intra-oral examination should always be made in an attempt to find a possible primary intra-oral or pharyngeal tumor.

Tuberculous cervical adenitis is a constant problem in diagnosis of lateral neck tumors. This problem is not met as often in America as in other countries in which unpasteurized milk is commonly used. In patients who do not have a history suggestive of tuberculous adenitis and in whom there is a mass anterior to the sternocleidomastoid in the upper third of the neck, there are other palpable cervical nodes which will help with the diagnosis. Frequently the diagnosis is made only at the time of operation. Thyroid adenomas are usually easily distinguished from branchial cysts as the adenomas move when the patient swallows.

TABLE I
SUMMARY OF FINDINGS

	Branchial Fistulas	Branchial Cysts
Age at onset	Birth to 10 yr.	Usually 20 to 30 yr.
Average age when first examined	18 yr.	31 yr.
Family history	Of no significance	Of no significance
Appearance	Small opening in skin	Globular mass of variable size
Location	Anterior to sternocleidomastoid muscle in lower third of neck	Anterior to sternocleidomastoid muscle in upper third of neck
Symptoms	Pain with obstruction	Pain with infection
Preoperative diagnosis	All correct	Frequently correct
Pathologic condition	Lined with stratified squamous, occasionally with ciliated pseudostratified columnar epithelium	Lined with stratified squamous, pseudostratified squamous and columnar epithelium
Operative incision	Usually stepladder	Variable
Tract followed to pharynx	In all cases	Frequently
Complications	Recurrent nerve paralysis	Several minor complications

On occasion it may be necessary to aspirate a lateral cervical tumor for diagnosis. The fluid obtained may contain cholesterol crystals which are indicative of branchial cysts. We have not found it necessary to inject the cyst with lipiodol for roentgenographic studies to outline the extent of the cyst.

Pathology. In fifty-six of the fifty-nine cases the microscopic pathologic findings were confirmed as being compatible with a branchial cyst. The cysts were lined with various types of epithelium, namely, stratified squamous, pseudostratified squamous and columnar. The walls of the cysts were fibrous and in many cases there were numerous lymph follicles.

Operation. The operation consisted of enucleation and excision of the entire cyst. Various types of incisions were used depending upon the size of the cyst; transverse, oblique and longitudinal incisions were used most often. In contrast to fistulas a stepladder incision was used in only three cases. The surrounding anatomic structures involved in excising the cyst are the same as those previously discussed relative to excision of branchial fistulas. (Fig. 4.) In only fourteen cases was the cyst found to be directly attached to the pharynx.

Results. The results for the most part were satisfactory. In most cases the wounds healed by primary union, with no recurrence. In fourteen cases, however, there were variable symptoms and complications following excision of the cysts. These are as follows: partial hypoglossal paralysis, two; tender scar, one; keloid, three; excessive serous drainage, two; purulent drainage, one; recurrent swelling up to two years, one; paralysis depressor angularis oris, one; aching neck, one; mild cellulitis, one and wound granulated, one.

SUMMARY

We have presented a study of seventy-five cases of branchial cysts and fistulas relative to their clinical aspects and treatment. Their possible similar embryologic derivation has been purposely ignored. The findings relative to this series are summarized in Table 1.

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Tetanus antitoxin neutralizes the toxin produced by the tetanus bacilli but the tissue cells of the host have to destroy these organisms by a process of phagocytosis. Accordingly, several authorities have recently prevented clinical tetanus from developing by giving the patients large doses of procaine penicillin intramuscularly for a few days after accidental injuries. In fact, in allergic individuals one can rely on penicillin alone; but if no contraindication to horse serum exists, one also gives injections of tetanus antitoxin in the prophylaxis of this dreaded disease. (*Richard A. Leonardo, M.D.*)

DUODENAL DIVERTICULA*

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REPORTS from the literature in regard to duodenal diverticula, although sporadic prior to 1930, have been abundant and adequate since. Information relating to the incidence, pathogenesis and clinical and radiologic findings is now exhaustive and excellent. For these details the reader is referred particularly to the treatises of Case,[7] Edwards,[8] Friedlaender,[12] Horton and Mueller,[14] Lockwood,[15] Finney,[10] and Frank.[11] It is a well recognized fact that the vast majority of duodenal diverticula are asymptomatic and innocuous. However, these diverticula not infrequently produce symptoms simulating gallbladder disease, peptic ulcer syndrome and acute appendicitis. It is not generally recognized that they may be the cause of obstruction of the common bile duct with associated cholangitis and jaundice, acute or chronic pancreatitis, ulceration and perforation, massive hemorrhage and rarely malignancy. The intention of this paper is to present a short series of cases to bring emphasis upon the complications of duodenal diverticula. For the purpose of classification and definition we may briefly review duodenal diverticula in general by noting a few cardinal features as presented by various authors.

The incidence, as shown by clinical reports, varies from 0.1 to 6.0 per cent with the majority showing a variation from 0.5 to 2.5 per cent. In 10,197 consecutive gastrointestinal series at the Albany Hospital eighty duodenal diverticula have been noted, which is an incidence of approximately 0.8 per cent. There is a marked increase in incidence, however, from the anatomist's point of view. Baldwin[2] reported an incidence of 14.2 per cent and Ackerman[1] following his excellent anatomic studies of fifty cadavers noted an incidence of 22 per cent. Inasmuch as most writers agree that many of these diverticula are not discernible by x-ray, clinical estimates regarding the incidence are probably low. Those of the third and fourth parts of the duodenum are probably frequently missed in routine gastrointestinal x-ray studies when they are not particularly sought out. The barium-filled stomach undoubtedly obscures many diverticula which would be revealed only when the patient is examined in a recumbent position and when oblique and lateral fluoroscopy is done and films taken. With the rapid passage of barium through the duodenum those diverticula with narrow necks fail to fill and are thus missed entirely. Since the methods used by anatomists are apt to result in artefacts, the true incidence probably lies between the two extremes.

Although these diverticula may be classified in several ways, the most common modern nomenclature places them in primary and secondary types. The former are true pouches that are in communication with the bowel and are not the result of any apparent intrinsic or extrinsic disease. The latter are due to some extrinsic pathologic disorder resulting in adhesions which produce traction. Some authors differentiate these on an anatomic basis, namely, that the primary or true types are devoid of any muscle layer whereas the secondary types are made up of all three layers. Although the latter is true, the former is not in all cases.

The most common location for these diverticula is in the second portion of the duodenum in the region of the ampulla. From roentgenologic studies about 75 to 80 per cent occur in this segment whereas the remaining number are divided between the third and fourth portions. However, if Ackerman's[1] postmortem studies have any significance, one must assume that actually there are as many diverticula in the third and fourth parts of the duodenum as there are in the second part. Some authors state that these pouches rarely if ever occur in the first part of the duodenum whereas others have pointed out that they do occur occasionally in the first segment. An interesting feature of one of the cases to be presented is that it is a primary diverticulum occurring in the first part of the duodenum.

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In regard to the pathogenesis the accepted thought today supports the existence of a congenital weakness, namely, that there is a locus minoris resistentiae resulting from the entrance of the bile and pancreatic ducts and the blood vessels into the duodenal wall. This is supported by the observation that the majority of diverticula are found in relation to these structures. The reason for the existence of those diverticula that arise on the convex or antimesenteric border is not quite clear. Perhaps, as Bockus[4] points out, the lack of intrinsic muscle tone, loss of supportive connective tissue around the blood vessels or other changes incidental to age are the only conditions necessary for the development of diverticula. However, as indicated by Edwards,[8] Finney[10] and others pulsion presupposes a sufficient pressure within the bowel to produce herniation of the mucosa through the weakened muscularis and eventually forcing ahead of it, the serosa producing a diverticulum. It is the general belief today that all acquired diverticula, not only of the duodenum but also of the colon, jejunum and stomach as well, are formed by a combination of the previously mentioned explanations, namely, pulsion and congenital weak spots.

There is considerable variation in the size of these pouches from small nubbins to large sacs. The neck of the sacs is sometimes narrow resulting in retention. Inflammation may develop resulting in thickening of the wall and distortion of its contour and may even give rise to ulceration and hemorrhage. The first definite radiologic demonstration of ulceration in a duodenal diverticulum was reported by Weig[24] in 1946. Although this was not proven by operation, pathologic evidence of ulceration in excised diverticula has been demonstrated.[22] Furthermore, numerous authors[4,10,17] have reported unquestioned cases of hemorrhage arising in duodenal diverticula which must have had their origin in ulcers within the sacculation. The inflammatory process may extend to the neighboring structures and involve, for example, the pancreas or common duct.

The present study is based on a review of twenty-seven cases in the Albany Hospital. The results are in general agreement with other reports, namely, the average age group is fifty-five, there is no material difference in incidence in regard to sex and there is no clear-cut picture or syndrome which is pathognomonic of duodenal diverticula. The symptoms may vary from epigastric distress to a constant dull pain in the epigastrium and are generally intermittent. There may be postcibal distress with repeated episodes of nausea and vomiting and even hematemesis. The diverticulum may present itself rarely as a primary disease of the biliary tract with gallbladder-like pain or jaundice. A most unusual and interesting case has been reported by Hare and Cattell[13] in which following cholecystectomy their patient had repeated episodes of biliary colic and jaundice and had a number of subsequent common duct explorations. Finally, the authors discovered in their surgical procedure that the patient had a duodenal diverticulum containing gallstones. Following removal of the diverticulum the patient was completely relieved of her symptoms.

It might even be manifested by an acute surgical condition of the abdomen as the result of perforation with catastrophic results. This situation is fortunately very uncommon but a few cases have been reported.[3,5,15,16,19] One of our cases is added to this list. Acute or chronic pancreatitis, which was directly attributable to an inflammatory process in a duodenal diverticulum, and neoplasms have been described in these structures by numerous authors.[18,20,23] It should be stated again at this juncture that in the vast majority of instances the duodenal diverticulum is asymptomatic.

The use of roentgen rays with barium meal offers the only means of making a conclusive diagnosis of duodenal diverticula. As a matter of fact, nearly all duodenal diverticula have been discovered during the course of routine gastrointestinal series which are carried out in an effort to determine the cause of upper abdominal complaints. One must be guarded in attributing the symptom complex in a given patient to a demonstrable duodenal diverticulum. All other possible causes for the clinical picture must be ruled out first. However, if there is otherwise unexplained pain and a tender duodenal diverticulum can be demonstrated under direct vision at fluoroscopy, barium retention being present in the sac, the symptoms can be considered due to the diverticulum and surgical interference is warranted. Several surgical technics have been advanced for the management of duodenal diverticulum. The oldest procedure has been the use of gastrojejunostomy, with or without occlusion of the pylorus, both in elective proce-

dures and for treatment of an acute surgical condition of the abdomen due to perforation. This procedure is ill advised because it is inadequate and, as Finney[10] states, evades the issue. Direct attack upon the duodenal sacculation is by all means the surgery of choice and several procedures have been recommended. Ferguson and Cameron[9] are among those who invert the sac after it has been isolated without opening it or the duodenum, approximating muscularis and serosa in separate layers transversely after the inversion has been accomplished. Pearse[21] has described a technic of excising the diverticulum after mobilization of the duodenum and isolation of the sac, describing a method of closing the neck without injury to the ampulla of Vater and pancreatic duct. Finney[10] has described an alternative procedure for diverticula deeply embedded in the pancreas and technically difficult to dissect out of the latter structure. Essentially it amounts to transduodenal curettage of the lining of the diverticulum through its neck followed with intraduodenal closure of the latter and closure of the duodenotomy. With the use of this procedure, Finney has had a reduced mortality rate. There has been no satisfactory solution for the surgical management of the disastrous perforation of a diverticulum of the duodenum.

Submitted hereafter are the case histories of six patients from a group of twenty-seven cases of radiographically proven instances of duodenal diverticula. These patients were admitted to the Albany Hospital over a fourteen-year period from 1937 to 1950, inclusive. We believe these diverticula have been primarily responsible for their symptoms. Cases I and II simulated peptic ulcers. Case III from autopsy findings demonstrated how a duodenal diverticulum can mimic biliary tract disease and Case VI presented the clinical picture of chronic cholecystitis. Case IV actually presented as an acute surgical condition of the abdomen. Also included is a case surgically treated by one of us (A. J. C.) at the Samaritan Hospital, Troy, New York, which clinically resembled chronic relapsing pancreatitis (Case V).

CASE REPORTS

CASE I. F. D. (Albany Hospital No. 17372), an Italian-born male, first appeared in the Medical Clinic at the Albany Hospital in January, 1940, complaining of burning epigastric pain and nausea of two months' duration which came on two to three hours after meals and was relieved by food or soda; this was associated with a weight loss of 5 pounds. The patient also complained of dyspnea and palpitation on exertion without edema or cough which had existed over a period of six months.

In 1936 he had been admitted to the Albany Hospital and operated upon for a right indirect inguinal hernia, with an uneventful recovery. On this admission he was found to have hypertension and cardiac hypertrophy with systolic and diastolic murmurs. Although he was working as a day laborer, he had no cardiac symptoms or abdominal complaints.

A gastrointestinal series was obtained in January, 1940, because of the complaints made in his first visit to the Clinic. The series revealed a normal esophagus and stomach but there was persistent irregularity of the duodenal cap consistent with a duodenal ulcer; the patient was placed on the usual medical ulcer regimen with partial improvement over a period of one year. From January, 1940, until January, 1944, he was followed up at weekly or bimonthly intervals in the outpatient department, during which time he had many recurrences of epigastric pain with nausea and occasional vomiting often accompanied with nocturnal burning pain. These symptoms were variably controlled with an ambulatory ulcer diet, amphojel and belladonna. Meanwhile the patient was increasingly incapacitated from dyspnea, weakness, nocturnal precordial distress and ankle edema.

Further gastrointestinal x-rays in 1941 and 1943 confirmed the original report of irregularity of the duodenal cap. Diagnoses of duodenal ulcer and hypertensive cardiovascular disease were made and both were appropriately treated. On January 12, 1944, the patient was admitted to the Medical Service of the Albany Hospital in cardiac failure. Moist rales at both bases, a liver enlarged four fingers below the costal margin and shifting dullness indicative of ascites and ankle edema were significant findings. The patient was treated with the usual cardiac regimen of digitalis, morphine and general cardiac care but on January 18, 1944, was found dead in bed at 6 A.M.

Autopsy revealed massive concentric hypertrophy of the heart, chronic passive congestion of the liver, spleen and kidneys, and diverticulum of the duodenum. The pathologist's report

of the gastrointestinal tract stated that: the esophagus was grossly normal and the stomach was of normal size and shape. The mucosa was found to be markedly thickened and congested and thrown into large folds. This process stopped abruptly about 3 to 4 cm. from the pylorus and the mucosa in this region appeared to be normal. In the first portion of the duodenum just distal to the pyloric sphincter there was a small (1.5 cm. in diameter) diverticulum which was rather shallow measuring 0.75 to 1.0 cm. in depth. A careful search was made for an ulcer in the stomach and duodenum but proved to be unsuccessful. The jejunum, ileum, cecum and colon appeared to be grossly normal.

Microscopic examination of a section of the duodenum taken through the diverticulum seen grossly revealed the muscular coats to be intact with the finding of an outpocketing of all layers rather than herniation of mucosa through the inner muscular layers.

Comment. The interesting features to be noted in this case are as follows: (1) a diverticulum existing in the first part of the duodenum; (2) a relatively small sac with adequate neck which was evidently symptomatic; (3) a diverticulum which simulated peptic ulcer from both a clinical and roentgenographic point of view.

Case II. R. H. (Albany Hospital No. 94302), a nineteen year old white male, was admitted to the Albany Hospital in May, 1942, because of hematemesis. His illness began four years prior to admission when without warning he vomited ingested food which terminated with emesis of approximately 2 to 3 ounces of blood. During the ensuing two months he had four or five episodes of vomiting which usually began one to two hours after meals and ended with a small amount of fresh blood. A gastrointestinal series obtained by his family physician at that time was reputed to be negative for disease of the esophagus, stomach and duodenum. The patient continued to experience bouts of emesis once or twice a month but without any bleeding. At no time did he ever experience any pain or nausea. His bowel habits were normal and there was no history of melena. Three days prior to admission the patient vomited a pint of material, much of it particles of food ingested seven hours previously; this was mixed with blood. During the next two days he experienced three similar episodes.

On hospitalization x-ray studies with barium meal revealed a normal esophagus, stomach and duodenal cap. A small duodenal diverticulum at the junction of the second and third parts of the duodenum was demonstrated. A temporary delay to the passage of barium in the duodenum just distal to the diverticulum was observed. Gastroscopy was negative. While in the hospital the patient vomited on one occasion; the vomitus was mixed with dark blood. The patient was placed on a progressive Sippy regimen and showed marked improvement. He was discharged on an ambulatory ulcer-type diet and did not thereafter return to the Clinic, with the result that his subsequent course is unknown.

Comment. The diverticulum was presumed responsible for the vomiting and hematemesis although the existence of a peptic ulcer not roentgenologically demonstrable cannot be denied.

Case III. M. M. (Albany Hospital No. 3410-29), a sixty-seven year old female, was admitted on May 19, 1929, complaining of sudden onset of severe pain in the left groin following bowel evacuation. Fifteen hours later she was admitted to the Albany Hospital as an emergency case, with the diagnosis of strangulated left femoral hernia. Past history revealed the presence of a reducible swelling in the left femoral region over a fifteen-year period which had been asymptomatic until the day of admission to the hospital. As far as could be determined the patient had been free of illnesses. Ten years previously she had suffered a fracture of the left hip which healed with full recovery. Examination on admission revealed an acutely ill but generally well preserved woman. The cardiorespiratory system was negative and the abdomen was found to be moderately distended and tympanitic. A tender, tense, fixed and irreducible mass the size of a plum was found in the left femoral region. Vaginal and rectal examinations were non-contributory.

Shortly after admission to the hospital the patient was taken to the operating room; through a left upper anterior thigh incision a femoral hernial sac was opened which was found to contain bloody fluid and a loop of bluish black but viable small bowel. The neck of the hernial sac was divided allowing replacement of the strangulated loop within the peritoneal cavity and the hernia was repaired. Following the operation the patient did poorly

in spite of supportive treatment and succumbed on the fourth postoperative day.

Autopsy revealed a complete mechanical intestinal obstruction proximal to a 5 cm. section of gangrenous jejunum which was fixed by fibrinous adhesions to the pelvic peritoneum adjacent to a recently repaired left femoral hernia. The cause of death was intestinal obstruction postoperatively, following repair of the strangulated left femoral hernia. A very interesting coincidental finding was a large duodenal diverticulum found lying on the medial aspect of the duodenum just distal to the ampulla of Vater with a crater-like neck 0.7 cm. in diameter. (Fig. 1.)

The sac was 4.0 cm. in length by 2.0 cm. in diameter. As it approached the duodenum, a definite neck was apparent which was in close proximity to the common bile duct and the pancreatic duct. The neck of the duct opened into the duodenum in juxtaposition to the ampulla of Vater. Proximally the common duct measured 1.4 cm. in diameter and as it was traced to the ampulla was found to be reduced in caliber with a definite constriction to a diameter of 0.2 cm. At this point the neck of the diverticulum was found to press against the common bile duct.

Comment. Had diverticulitis and peridiverticulitis developed it is not difficult to visualize how the associated edema would have completely occluded the common bile duct resulting in an obstructive type of jaundice. Although the diverticulum in this case was an incidental finding at autopsy, it is being presented because it so plainly portrays the manner in which perivaterial diverticula may involve the common duct with resultant cholangitis and obstructive jaundice thereby simulating disease of the biliary tract.

Case IV. M. R. (Albany Hospital No. 9951), a sixty-seven year old white male, was suddenly awakened in the early morning hours on March 11, 1937, with severe generalized abdominal pain which he described as the feeling of a tight metal band around the upper abdomen. This persisted and about four hours after onset was largely localized in the right upper quadrant at which time the patient was seen. His temperature and pulse were normal; there was tenderness in the right upper quadrant with some muscle-guarding but no spasm. Observation was advised. During that day the patient experienced nausea and vomited on several occasions. The following morning he was definitely worse and severe constant pain had localized in the right lower quadrant. On admission to the hospital on March 12, 1937, his temperature was 101.4°F. Examination revealed the abdomen to be somewhat distended and there was point tenderness and spasm in the right lower quadrant 4 cm. above and in line with the right anterosuperior iliac spine. No history of any previous gastrointestinal disturbances or abdominal pain was given; the patient for years had enjoyed eating rich and highly spiced foods which he ate sparingly in order to keep his weight down. Significant laboratory data were as follows: The Wassermann test was negative, white blood count was 22,000 and urinalysis disclosed a trace of albumin, a trace of sugar and a large number of granular and cellular casts.

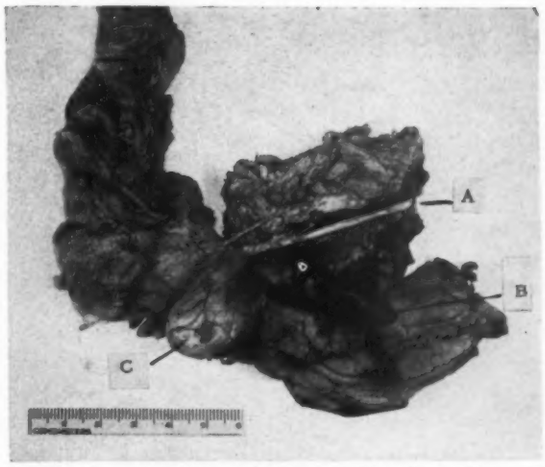
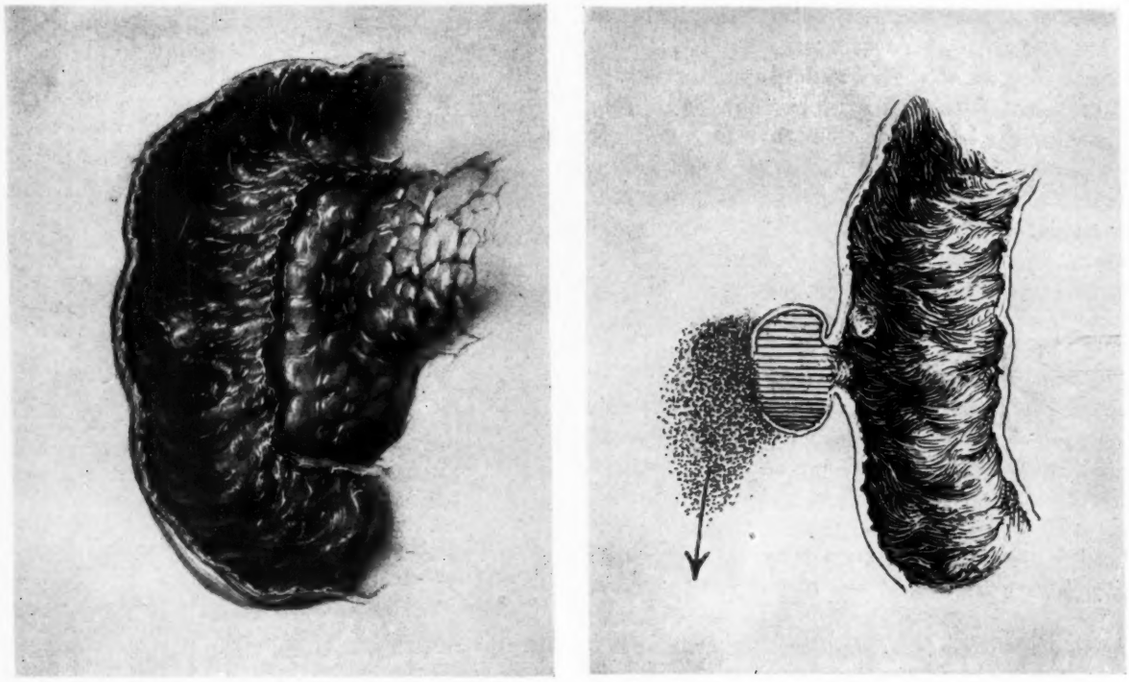


Fig. 1. An autopsy specimen revealing how the neck of a perivaterial diverticulum may constrict common bile duct and pancreatic duct at the ampulla of vater. A, pancreatic duct; B, common bile duct; C, perivaterial diverticulum.

Operative intervention was decided upon and the abdomen was entered through a McBurney incision. In the operative note the musculature of the abdominal wall was described as having been somewhat edematous and the peritoneal cavity as having contained a small amount of clear fluid. The peritoneal surfaces were smooth and glistening. No evidence of localized or generalized peritonitis was observed. The appendix was retroperitoneal in position and atrophic, measuring 2 cm. in length and 2 mm. in thickness with what appeared to be an area of beginning gangrene at its base. An appendectomy was performed and a drain inserted into



2A 2B

FIG. 2. A, Schematic representations of the diverticulum of the duodenum with perforation; B, the longitudinal section of the diverticulum is represented with the necrotic wall and perforation at the dome of the sac, and with the secondary abscess extending downward along the lumbar muscles. The close proximity of the opening of the diverticulum to the ampulla of Vater is clearly depicted.

the pelvis. The postoperative course was characterized by progressively increasing fever, restlessness, distention, cardiac failure and coma. The patient expired five days after operation.

Postmortem examination revealed a perforation at the apex of a duodenal diverticulum. The latter measured 2.0 cm. in diameter and 2.5 cm. in depth. (Fig. 2.) This communicated with a large retroperitoneal abscess which extended from the region of the duodenum downward along the right gutter to a point 4 cm. below the cecum. Macroscopic and microscopic analyses of the defect in the duodenal wall established it as a true periampullary duodenal diverticulum, with acute inflammation, necrosis and perforation.

Comment. This case represents an unusual but catastrophic complication of a duodenal diverticulum. As a cause of an undiagnosed acute surgical condition of the abdomen and mortality with or without the benefit of an abdominal exploration it probably occurs with greater frequency than the literature would indicate and should always be kept in mind in the differential diagnosis of acute intra-abdominal diseases. Early surgical intervention is obviously essential. When this problem is encountered, establishment of adequate surgical drainage must be accomplished as a fundamental surgical principle and may be all that can be done as an emergency procedure. Mobilization of the second portion of the duodenum allowing access to the pocketed material about the perforation in order to establish drainage is the logical primary procedure. Further drainage of the retroperitoneal areas along the right lumbar gutter either in the lower abdomen or behind the liver should be accomplished if there has been extension in these directions. Exploration of the lesser peritoneal sac should be considered and drainage instituted if warranted.

It is conceivable though quite unlikely that the neck of a diverticulum with a perforation might be relatively uninvolved in the inflammatory process and could be dissected free, cut across and inverted according to standard technics, with establishment of drainage thus accomplishing definitive treatment. Such therapy would be ill advised, however, if the inflammation and necrosis were extensive or the patient's condition critical; adequate surgical drainage alone would then be mandatory.

The performance of gastrojejunostomy with or without occlusion of the pylorus for this surgical emergency is adjudged by the authors as a useless, time-consuming procedure because it in no way affects the pathologic condition, namely, the existence of a duodenal fistula which first and foremost necessitates closure or external drainage. Having met the acute surgical problem by means of adequate drainage, infection should be controlled with the use of antibiotics; the altered physiology resulting from the loss of gastric, biliary and pancreatic secretions should be corrected with the proper administration of intravenous salt solutions, sodium lactate, blood plasma and whole blood in order to maintain fluid and electrolyte as well as protein and hemoglobin balance. At a later date, when the patient's condition warrants, definitive surgical attack on the duodenal diverticulum may be accomplished, again according to accepted technics.

Case v. M. V., (Samaritan Hospital No. 6360), a sixty year old married white Polish woman, was admitted to the hospital on August 22, 1949, complaining of severe pain in the upper abdomen of six weeks' duration. The pain was constant over this interval varying, however, in intensity. It lacked any relationship to food intake. The pain was described as burning in character and centered in the mid-epigastrium just to the left of the midline, radiating through to the back and upward under the sternum. There was no associated anorexia, nausea, vomiting or weight loss and no change in bowel habit. Similar though milder symptoms lasting for shorter intervals first made their appearance in 1941. In another institution the patient had an umbilical hernia repaired, apparently with the thought that it was the cause of her complaints. Following this surgical procedure she had repeated similar episodes of pain at irregular intervals. In 1944, also in another hospital, cholecystectomy was performed. For three or four months thereafter the patient was relatively asymptomatic but then had recurrence of her pain in periodic attacks. The past history, review of systems and the family history were non-contributory.

On admission to the hospital physical examination revealed the blood pressure to be 150/80, pulse 70 and respirations 18. There were no abnormalities of the head and neck. The lungs were clear; the heart was of normal size with regular rate and there were no murmurs. The abdomen was moderately obese and contained an upper right rectus and a transverse mid-abdominal scar which were healed without herniation. There were no palpable organs or masses. Tenderness in the mid-epigastrium more marked just to the left of the midline was demonstrated. Pelvic and rectal examinations were negative. Marked varicosities of both lower thighs and legs were present.

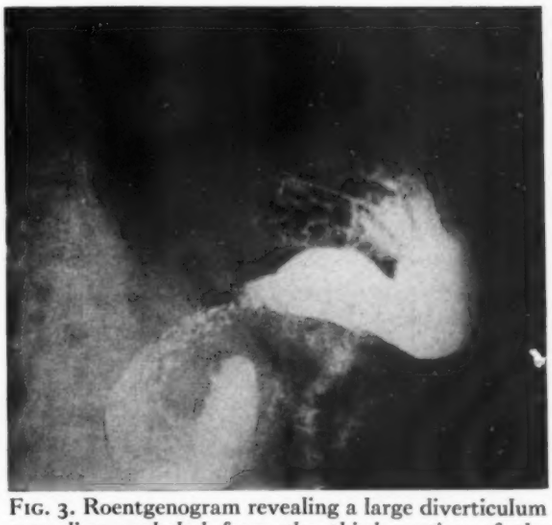


Fig. 3. Roentgenogram revealing a large diverticulum extending cephalad from the third portion of the duodenum.

Laboratory studies revealed a hemoglobin of 13 gm., a red cell count of 4,300,000 and a white blood count of 10,800, with a normal differential count. The non-protein nitrogen was 25 mg. per cent and the serum protein 5.5 gm. The blood chlorides were 462 mg. Urinalysis as well as a Wassermann test was negative.

A gastrointestinal series demonstrated a normal esophagus, stomach and duodenal cap. There was a large diverticulum projecting from the third portion of the duodenum which was apparently causing partial obstruction to the passage of barium through that portion of the intestine. (Fig. 3.) With pressure over the site of the diverticulum marked tenderness was elicited. There was a large six-hour gastric residue evidently due to slow emptying of the duodenum and barium was found to be retained in the diverticulum. There was also a twenty-four-hour residue in the diverticulum.

On September 8, 1949, under general anesthesia the abdomen was opened through an upper transverse abdominal incision. The third portion of the duodenum was exposed through

the gastrocolic ligament. Arising from the anterosuperior aspect of the duodenum in this location, a diverticulum measuring approximately 6.0 by 2.5 cm. was found. Close to the neck of the diverticulum on its superior aspect it was crossed obliquely by a vein producing a bicornuate effect. The smaller horn extended posterosuperiorly and measured approximately 2.5 by 1 cm. This smaller pouch was thickened and edematous, and was embedded in the body of the pancreas. The adjacent pancreatic tissue was markedly indurated. Both horns of the diverticulum had a common neck. They were resected leaving a small cuff of the neck which was closed transversely with a continuous mattress suture of atraumatic chromic catgut re-enforced with a layer of interrupted Lembert sutures of No. 000 black silk. A cigarette drain was placed down to the pancreatic bed and the abdomen was closed in layers.

The postoperative course was uncomplicated except for the drainage of a clear, colorless fluid (pancreatic secretions) for a period of six weeks. The patient was asymptomatic in the short period that she was followed up.

The pathologic report revealed the following: The specimen consisted of an irregular, thickened, edematous, saccular or pouch-like piece of tissue which measured 6.0 cm. in length and 2.5 cm. in diameter. The walls were thickened and mottled in appearance. Microscopic examination disclosed a diverticulum of the duodenum showing chronic inflammation, superficial ulceration and fresh mucosal hemorrhage. Pyloric type of gastric glands were noted in the mucosa.

Comment. The clinical picture in this case, to a considerable degree, has strong resemblance to that which we have come to regard as typical of chronic relapsing pancreatitis. In fact the patient did have a secondary type of chronic, local pancreatitis in conjunction with an inflammatory diverticulum of the third portion of the duodenum. This case was properly treated surgically because of the demonstration of tenderness and the retention of barium in the diverticulum.

Case VI. E. K. (Albany Hospital No. A99665), a sixty-five year old woman, was seen for the first time on February 8th, 1950, by one of us (P. G.) and recounted the following medical history. In 1935 at the age of fifty years she began having right upper quadrant soreness and vomited everything eaten. These symptoms were continuous over a period of three years. During this interval she had progressive weakness and weight loss. At the end of this time the persistent vomiting suddenly stopped but thereafter, for a period of two years at irregular intervals, she had sharp right upper quadrant pain lasting for about a half hour. Usually this pain occurred shortly after she had eaten and was associated with occasional vomiting. Hematemesis was never noted. At this time the patient's family physician obtained a cholecystogram and she was told that she had no gallstones and that the condition was "chronic." Intermittently since that time, over a ten-year period, she had similar symptoms consisting of soreness and occasional sharp pain in the right upper quadrant, epigastrium and substernal region, with occasional vomiting without fever or jaundice. During the course of her illness she had six different hospital admissions for these complaints but no further x-ray studies were obtained. Each time she was told that her symptoms were due to "nerves" and that no operation was necessary.

In July, 1949, she accidentally slipped and fell on her back. Over a period of two weeks she had progressive pain in the lumbar region. She was hospitalized for this and was kept in bed for seven weeks. In October, 1949, a sharp, intermittent, frequent epigastric pain developed which radiated substernally into the right upper chest. This was exaggerated when the patient ate anything or even drank water. The patient also experienced pain in her right upper quadrant which was sharp and burning in character; this bothered her particularly at night, awakening her two or three times. Her symptoms continued and progressed and were alleviated only by analgesics given her by the family physician. Throughout the course of this last illness she had vomited only on two or three occasions and there was no hematemesis.

On October 24th, 1949, her family physician obtained a gastrointestinal series which revealed the presence of a large diverticulum of the fourth part of the duodenum with tenderness and retention. In spite of intensive medical efforts over a period of three months the patient remained unrelieved and had become exhausted from inadequate food intake and lack of sleep.

Review of her past health revealed that twenty years previously she had had her right breast removed; eighteen years before she had had acute appendicitis with appendectomy;

and fifteen years prior to being seen had had a nodule removed from the left breast. She had been treated for "high blood pressure" for several years. The review of systems was negative and the family history was irrelevant.

Physical examination revealed a very pleasant, markedly obese, healthy looking older woman with good color and muscular tone, weighing 220 pounds. Examination of the head and neck was negative. The right breast had been amputated and there was a transverse, well healed scar. The left breast was pendulous and atrophic with a scar in the lower inner quadrant. The patient's heart was not enlarged to percussion and the sounds were of good quality without murmurs. Her blood pressure was 190/100 and her lungs were clear. The abdomen was tremendously obese with an intact, irregular right lower quadrant scar; the liver descended two fingers below the costal margin on deep inspiration but was smooth and non-tender. In the midline of the epigastrium and just to the right, midway between the xiphoid process and umbilicus, there was specific, sharp tenderness without spasm or palpable mass. The rest of the abdomen was soft and non-tender. Examination of the pelvis and rectum as well as the extremities was negative.

On February 16, 1950, the patient was admitted to the Albany Hospital. The laboratory studies were as follows: Urinalysis was negative except for occasional microscopic white blood cells. Blood picture: packed cell volume 49, hemoglobin 15.0 gm., white blood count 7,300, granulocytes 84 per cent and lymphocytes 16 per cent; Wassermann test was negative, blood sugar 95 mg. per cent, non-protein nitrogen 47 mg. per cent, serum protein 6.8 gm. per cent, albumin 3.4 gm. per cent, globulin 3.4 gm. per cent and serum chlorides 660 mg. per cent.

X-ray studies of the chest revealed no evidence of pulmonary tuberculosis or of primary or metastatic tumor. Study of the abdomen showed no unusual gas accumulations in the intestinal tract and no apparent stones in the kidneys, ureters or bladder. A gastrointestinal series was reported as follows: The esophagus, stomach and cap were normal and there were no defects to suggest ulcer or new growth. At the junction of the third and fourth portions of the duodenum there was a large outpocketing defect which extended toward the greater curvature side of the stomach and measured 4.5 cm. in diameter. This was consistent with a large duodenal diverticulum which apparently contained retained food. However, the possible presence of a gallstone eroding through the wall of the duodenum could not entirely be excluded. In twenty-four hours there was retention of barium within the previously described sacculation.

A preoperative diagnosis of diverticulum of the duodenum at the junction of the third and fourth parts with retention was made and preparations were started for surgery.

On February 20, 1950, the duodenal diverticulum was excised. A long upper abdominal transverse incision was made including both rectus muscles. The stomach, duodenum, liver, gallbladder, common duct and pancreas were found to be normal. The appendix had been removed previously and there were a few adhesions in the right lower quadrant. The pelvic organs were those of a postmenopausal female. The gastrocolic ligament was widely opened and the stomach was retracted upward. The peritoneum overlying the fourth portion of the duodenum was incised and the duodenum was mobilized. A large mass lying above and to the right of the more cephalad portion of the duodenum in its fourth part was found embedded and fixed in the retroperitoneal tissues. This was carefully dissected out and was seen to represent a duodenal diverticulum approximately 4 cm. in diameter which on palpation was filled with a hard concretion. It was attached to the duodenum through a broad neck. It was elliptically excised and the duodenum was closed transversely with three separate layers of sutures. The peritoneum was reapproximated and the ligament of Treitz, previously divided to allow mobilization of the diverticulum, was reconstructed; the abdominal wall was closed in layers without drainage.

The pathologic report was as follows: Grossly, the specimen consisted of a wide-mouthed diverticulum said to be from the fourth part of the duodenum measuring 4 cm. in diameter and containing firm, amorphous, yellowish brown material. Diagnosis was diverticulum of duodenum, chronic duodenitis.

The postoperative course was entirely uneventful and the patient was discharged to her home on the tenth postoperative day. In the recent follow-up except for some weakness and occasional flatulence the patient has been asymptomatic.

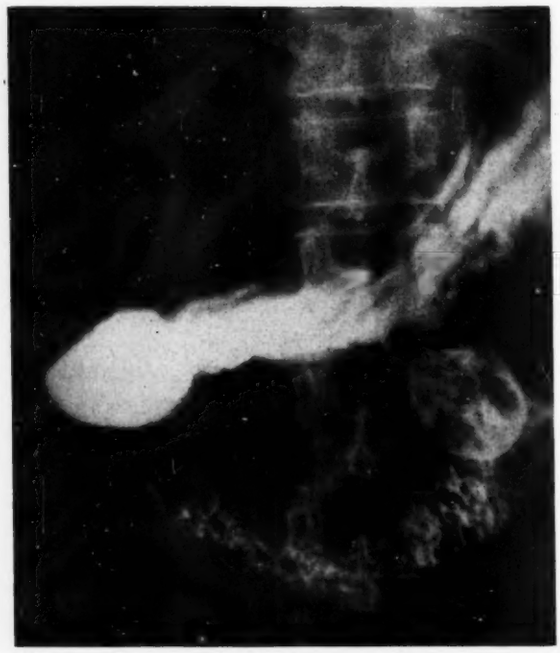


FIG. 4. Roentgenologic demonstration of a large diverticulum of the fourth portion of the duodenum in which barium is thinly dispursed within the saccula-tion by impacted intestinal contents.

Figure 4 reveals the diverticulum of the fourth portion of the duodenum demonstrating how the barium was dispersed thinly by the contained impacted material. Figure 5 is a photograph of the excised diverticulum with its contained desiccated food and gastroduodenal contents.

Comment. In this case a diverticulum of the fourth part of the duodenum was present, with retention-produced symptoms over a fifteen-year period simulating biliary colic. Since on one occasion a cholecystogram was normal, the clinical picture was adjudged to be on a functional basis. Had a gastrointestinal series been obtained as part of a more complete study at an earlier date, the correct diagnosis could have been made and the patient through appropriate surgery would have been saved many years of suffering. In this instance a duodenal diverticulum with a wide neck apparently intermittently became filled with desiccated food and gastroduodenal secretions resulting in stasis inflammation of the diverticulum and the contiguous duodenum. As noted in the operative report there was no other intra-abdominal cause for her symptoms and operative extirpation of the diverticulum was warranted on the basis of the severity of the symptoms, tenderness and the roentgenologic demonstration of retention within the duodenal diverticulum.

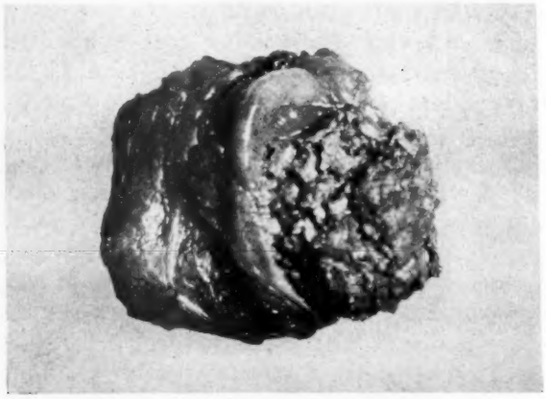


FIG. 5. The excised diverticulum of the fourth portion of the duodenum demonstrated roentgenologically in Figure 4 is depicted containing desiccated and impacted food and upper gastrointestinal secretions.

SUMMARY AND CONCLUSIONS

1. The vast majority of duodenal diverticula, probably occurring with greater frequency than would be indicated from reports based upon radiographic examinations, are asymptomatic and innocuous.

2. When there are upper abdominal symptoms for which after careful study no other cause can be found except a roentgenographically demonstrable duodenal diverticulum with either ulceration or tenderness at fluoroscopy and barium retention, surgical intervention is advisable.

3. There are certain complications of duodenal diverticula, though far from common, which occur with sufficient frequency to be borne in mind by the internist and surgeon in making a differential diagnosis. These are hemorrhage, obstructive jaundice, acute and chronic pancreatitis, perforation and malignant transformation, all of which are specific surgical problems.

4. Six cases are presented which we believe demonstrate some of the pathologic processes which may result from duodenal diverticula.

5. The authors express what they believe to be the best method of dealing with perforation of a duodenal diverticulum.

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CARCINOMA OF THE AMPULLA OF VATER*

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CARCINOMA of the papilla of Vater is unique among the carcinomas of the gastrointestinal tract in that the onset of obstructive jaundice early in the course of the disease frequently suggests the diagnosis at a time when surgery offers optimal chance of cure. Carcinoma of the ampulla of Vater is also unique in that the relatively slow growth and metastatic spread of some of the lesions offer the surgeon the opportunity for palliation of a dramatic degree, and possibly even cure, many months after the onset of symptoms referable to the lesion. It is the purpose of this paper to present two cases amenable to definitive surgery twenty-one and twenty-two months after the onset of symptoms, to review briefly the subject of carcinoma of the ampulla of Vater and to emphasize the value of duodenotomy in the diagnosis of this lesion at the time of surgical exploration.

Carcinoma of the ampulla of Vater is generally considered to have a fairly low grade of malignancy. Cole and Reynolds[11] reported a case of carcinoma of the ampulla of Vater with onset of symptoms three years prior to surgery. Pancreatoduodenal resection was performed and the patient was well six months after surgery. Baggenstoss[1] reported fifteen of twenty-eight cases of carcinoma of the ampulla of Vater showing no metastasis at the time of necropsy. Siler and Zinninger[20] have pointed out, however, that these lesions may have a high degree of malignancy and they have noted a case in which liver metastases developed between stages of a two-stage pancreatoduodenal reaction. The published results of pancreatoduodenal resection, however, indicate a much more favorable prognosis for carcinoma of the ampulla of Vater than for carcinoma of the head of the pancreas following operative treatment.[5,8,11]

Grossly, carcinoma of the ampulla of Vater usually gives a firm mass in the region of the ampulla from 1 to 4 cm. in diameter. The lesion may be papillary but is more frequently ulcerative. Because of the location of the lesion, obstructive jaundice and cholangitis may result in early death. If death does not ensue, extension by local spread to involve the head of the pancreas and major pancreatic ducts may occur. At this stage the head of the pancreas may be large, firm, and there may be the same dilatation of the biliary system and pancreatic ducts as found in primary carcinoma of the head of the pancreas. This makes gross pathologic differentiation impossible without visualization of the interior of the duodenum. Local extension may result in invasion of the portal or superior mesenteric vein. Metastasis to the regional lymph nodes and liver occurs relatively late; death may occur from the local lesion in the ampulla with its physiologic complications prior to these metastases.[1]

Microscopically, the lesions are all adenocarcinomas and may vary from scirrhous adenocarcinoma to papillary adenocarcinoma. It may be microscopically and macroscopically impossible for the pathologist to differentiate carcinoma of the papilla from primary carcinoma of the ampullary portion of the duodenum. It is believed that the majority of these carcinomas arise from the papilla.[17] Cattell believes that benign lesions of the ampulla of Vater are more common than generally appreciated and are important precursors of malignant disease.[10] Some reports give an extremely low incidence of carcinoma of the ampulla of Vater;[20] however, there have now been numerous series of cases reported in which there have been pancreatoduodenal resections for various causes.[5,8,12,16,20,22] In all of these reports carcinoma of the ampulla of Vater constitutes a conspicuously high proportion of these cases. A major reason for this is that carcinoma of the head of the pancreas is much less likely to be

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diagnosed at an operable stage. In spite of this fact the total number of cases of carcinoma of the ampulla of Vater which have been reported suggests that this carcinoma is not as rare as previously believed.

The clinical picture of this disease is not definitely diagnostic but the location of the lesion leads to a definite train of symptoms and suggests a line of diagnostic investigation. Obstruction of the common duct produces early obstructive jaundice with anorexia, vomiting and weight loss. The gallbladder is frequently palpable according to Courvoisier's law. Obstruction of the pancreatic duct may occur with symptoms of pancreatic pain, further malnutrition and steatorrhea. Ulceration of the duodenum is accompanied with varying degrees of blood loss. The stools are usually positive for occult blood, duodenal drainage may yield gross blood and anemia is frequently a prominent feature of the disease. In the diagnostic study obstructive jaundice must be differentiated from hemolytic and hepatocellular jaundice. The type of anemia should be determined. Pancreatic dysfunction if present may occasionally be detected by finding increased serum amylase, a diabetic type glucose tolerance curve, increased fat content in the stool and decreased pancreatic ferments in the duodenal drainage. The value of duodenal drainage in the diagnostic study of this condition should not be overlooked. The finding of gross blood in the drainage strongly supports the diagnosis. A papanicolaou cell study of duodenal drainage should be made for neoplastic cells.

Roentgenologically, these lesions are difficult to demonstrate. There may be a filling defect in the region of the ampulla (reversed 3 sign). Erosion of the mucosa or narrowing of the lumen may be visible in infiltrating lesions. Failure to demonstrate the lesions roentgenologically is frequent and does not exclude its presence.[13]

The differential diagnosis must include benign lesions of the ampulla, common duct stones, strictures and tumors, subacute pancreatitis with jaundice, and carcinoma of the pancreas or the stomach with secondary invasion of adjacent structures. Carcinoma of the ampulla should be the working diagnosis in cases which present the following clinical picture: (1) obstructive jaundice early in relation to other symptoms; (2) anemia, occult blood in the stools and blood in the duodenal drainage; and (3) x-ray findings of a filling defect or erosion in the second portion of the duodenum.[20]

Even at exploration the operative findings may be difficult to interpret. Typically, the surgeon finds a markedly dilated common duct and gallbladder and an enlarged bile-stained liver. The pancreas may be large and indurated simulating either pancreatitis or carcinoma of the pancreas. An ampullary mass may be palpable and may simulate a stone impacted in the ampulla. Usually examination of regional nodes will show no evidence of metastasis. When these findings are presented, a duodenotomy with biopsy and frozen section examination if necessary is recommended to establish the correct diagnosis. Choledochotomy and probing of the common bile duct if not combined with duodenotomy will usually fail to establish the diagnosis and is frequently misleading even as a means of establishing the patency of the common duct opening. Duodenotomy allows differentiation of carcinoma of the ampulla of Vater from impacted ampullary stone, from benign tumor of the ampulla and from carcinoma of the head of the pancreas. Cattell,[7] Orr,[16] and Siler and Zinninger[20] have stressed the value of diagnostic duodenotomy. Duodenotomy was necessary to establish the diagnosis in the two cases being reported.

When the diagnosis of carcinoma of the ampulla of Vater has been made, the operative procedure to be performed has been fairly well established. The generally accepted minimal resection is removal *en bloc* of the head of the pancreas, the terminal common bile duct and the duodenum down to the ligament of Treitz.[24] Whipple, Parsons and Mullins[23] introduced the two-stage pancreatoduodenal resection in 1935. Numerous variations of technic, mostly concerning the manner of reconstruction, have been added. The advances in preoperative preparation of the patient, particularly in the use of vitamin K, chemotherapeutic agents and blood transfusions, have culminated in the development of a one-stage procedure as the operation of choice in a large percentage of cases. The two-stage pancreatoduodenal resection still has a distinct field of usefulness in the extremely poor risk patient.[2–4,14,15,18,20,21]

Pancreatoduodenal resection remains a formidable operative procedure and should be performed only if the diagnosis of malignancy can be established at operation and if the lesion is grossly completely resectible.[16] For this rea-

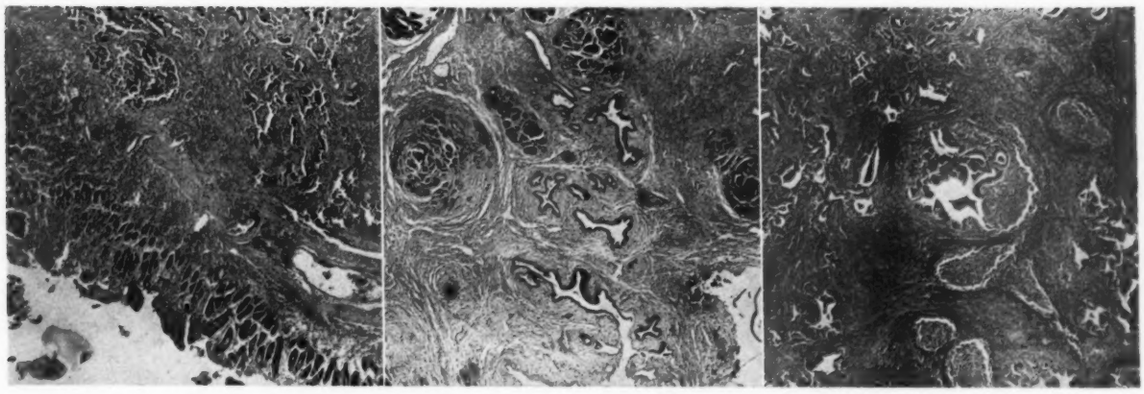
son it is important to determine that the lesion can be freed from the superior mesenteric vein and the portal vein before the bowel or its blood supply is divided.[7,11] In the reconstruction choledochojejunostomy is preferred to cholecystojejunostomy because of the frequency of "blow-out" of the ligated common bile duct with bile peritonitis or biliary fistula.[3,7,11] Drainage of the biliary tract should be proximal to the gastric anastomosis to avoid the passage of food over the common duct opening.[7] It has been shown that a fairly normal state of nutrition can be maintained without reanastomosis of the pancreatic duct to the bowel. Brunschwig[6] believes that reanastomosis adds to operative time and believes that the reanastomosed duct probably does not remain patent. Return of the extrinsic pancreatic secretion to the bowel, however, is physiologic and adds to the well-being of the patient.[19] In addition failure to anastomose the pancreatic duct frequently results in troublesome pancreatic fistulas.[11,16] For these reasons many authors believe that anastomosis of the pancreatic duct should be performed and several technics to accomplish this have been recorded.[7,9,22]

CASE REPORTS

CASE 1. J. W. W. (No. 55817), aged forty-nine years, was admitted for severe epigastric pain. Past history revealed the onset in April, 1948, of severe epigastric distress and jaundice, and on May 2, 1948, a cholecystostomy had been performed elsewhere. The pancreas was said to have been large and edematous and the gallbladder dilated without stones. On May 26th at a second operation a cholecystojejunostomy had been performed. A biopsy of the head of the pancreas at that time was reported to show fibrosis. In the interval prior to admission to this hospital the patient had had recurrent episodes of upper abdominal pain, occasional vomiting and diarrhea and loss of weight.

Physical examination revealed poor nutrition and tenderness in the epigastrium and right upper quadrant. X-ray studies were negative except for air in the gallbladder and biliary passages. The erythrocyte count of 3,400,000 on admission fell to 2,500,000. A glucose tolerance test showed a diabetic curve. Serum amylase, normal on several occasions, rose to 310 mg. per cent following one episode of epigastric pain. Duodenal drainage was pink from gross blood. The preoperative preparation of the patient corrected the hypoproteinemia, the anemia and electrolytic imbalance. This was accomplished largely by high protein diet and numerous blood transfusions. On February 28, 1950, a celiotomy revealed the following: (1) functioning cholecystojejunostomy; (2) the common bile duct dilated to 2.5 cm.; (3) the liver revealed no metastasis; (4) marked firmness and nodularity of the head and body of the pancreas; (5) biopsy and frozen section of the pancreas showed chronic pancreatitis; (6) frozen section of pyloric node revealed an adenocarcinoma; (7) there was no pathologic condition demonstrable in the duodenum by palpation. A duodenotomy was necessary to demonstrate the presence of an ulcerative lesion of the ampulla which measured 4 by 4 cm.

A pancreaticoduodenal resection of the entire duodenum and head of the pancreas was then performed. Reconstruction consisted of closure of the jejunum at the ligament of Treitz and end-to-side anastomosis of the common duct to the jejunum over a T tube near the site of the previous cholecystojejunostomy which was not disturbed. An end-to-side gastrojejunostomy was then performed. The pancreatic duct was ligated and the pancreas closed with interlocking sutures. A jejunojejunostomy was then performed to preclude further the possibility of enteric contents passing to the area of the choledochojejunostomy. A rubber tissue drain was placed down to the pancreatic bed and brought out the left margin of the wound. The patient had a remarkably smooth postoperative course; he sat up on the second day and walked on the third. There was drainage of a small amount of fluid resembling pancreatic juice but with no excoriating effect on the skin, which gradually diminished. On March 18, 1950, the drain was removed. On March 29th severe epigastric pain developed deep beneath the drain site, with leukocytosis to 19,400. Serum amylase was 308 mg. per cent. Observation until March 30th confirmed the impression of accumulation of pancreatic juice retroperitoneally when it was possible to insert a catheter into the drainage tract and withdraw 1 ounce of yellowish, clear, sterile fluid with immediate and dramatic relief of pain. The serum amylase



1 2 3

FIG. 1. Case 1. Hematoxylin and eosin stain, 50 ×. Adenocarcinoma in the duodenal wall; marked desmoplastic reaction.
FIG. 2. Hematoxylin and eosin stain, 50 ×. Marked fibrosis, pericanalicular, of the head of the pancreas; no invasion of this organ by tumor.
FIG. 3. Hematoxylin and eosin stain, 50 ×. Metastatic adenocarcinoma to regional lymph node.

then fell to 92 mg. per cent. There was gradually decreased drainage of pancreatic juice and none has occurred since about April 15th.

When last seen the patient was asymptomatic, well nourished on a regular diet with pancreatic extract, 15 gm. daily, and had gained from 116 pounds in the immediate postoperative period to 127 pounds. He was free of pain which had required daily opiates prior to surgery.

Pathologic report revealed an ulcerating carcinoma of the ampulla of Vater, with superficial penetration into the pancreas, metastasis to one lymph node and marked fibrosis of the pancreas. (Figs. 1 to 3.)

In this case the lesion was operable twenty-two months after the onset of symptoms. Even after this period at the time of surgery the site of origin and true nature of the condition was not obvious until duodenotomy for direct visualization of the ampullary area had been done.

CASE II. A. P. E. (No. 54279), a seventy-five year old white male, was admitted to the hospital complaining of painless jaundice of two weeks' duration. He gave a history of two previous admissions for jaundice, twenty months before admission and twelve months before admission. On both previous admissions he had presented anorexia, vomiting, weight loss, obstructive jaundice and anemia. On both occasions the jaundice had subsided spontaneously but he had failed to regain weight and strength. Two weeks before admission he again developed jaundice with light stools and dark urine and complained of itching, anorexia, vomiting and weakness.

On physical examination the patient appeared chronically ill, emaciated and showed evidence of recent weight loss and anemia. There was moderate jaundice and pallor. The liver edge was palpable, smooth and firm. The gallbladder was not palpable.

The clinical laboratory investigation was consistent with the preoperative diagnosis of incomplete extrahepatic obstruction with severe hepatocellular damage. A profound anemia was present (hemoglobin 58 per cent). Occult blood was present in the stools and duodenal drainage. X-ray studies showed a small amount of miliary calcification in the pancreas. There was no displacement of the duodenal loop. The gallbladder did not visualize. Preoperative treatment included frequent feedings of high protein, low fat diet supplemented with intravenous electrolytes, glucose, protein hydrolysate and blood. Large doses of vitamin K and ascorbic acid were given. Large quantities of blood were necessary to combat the anemia.

Celiotomy was performed which revealed the liver to be markedly enlarged and bile stained. The gallbladder and biliary tree were dilated. There were no visible or palpable metastases in the lymph nodes or liver. The pancreas showed moderate fibrosis. A firm nodule 1½ cm. in diameter was felt on the posterior duodenal wall in the region of the ampulla. By palpation it was impossible to determine whether this nodule represented tumor or an impacted stone in the ampulla.

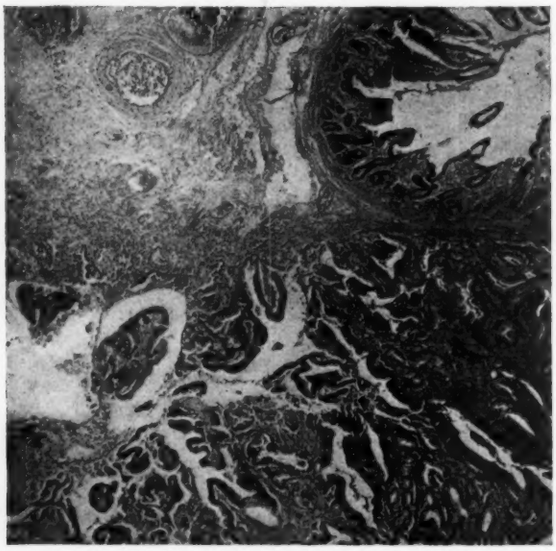


FIG. 4. Case II. Hematoxylin and eosin stain, 50 ×. Irregular gland-like formations constituting the duodenal malignancy.

The dilated common duct was opened and a flexible probe could not be passed into the duodenum. A duodenotomy of the anterior duodenal wall overlying the ampulla was then performed. A tumor was seen on the posterior duodenal wall which consisted of a shallow ulceration 4 cm. in diameter. The upper portion of the ulcerated area contained a 1½-cm. nodule. Grossly, the ulceration involved the mucosal layer only.

Resection of the second portion of the duodenum was performed which removed the retroduodenal portion of the common bile duct and a small portion of the head of the pancreas with the terminal pancreatic duct. In the repair the first and third portions of the duodenum were reanastomosed. The common duct was anastomosed to the duodenum over a T tube and the dilated pancreatic duct was anastomosed to the duodenum over a small segment of rubber catheter.

The pathologic report was adenocarcinoma of the ampullary portion of the duodenum. The tumor cells stained positively with a mucin stain pointing toward duodenal mucosa as the origin of this tumor. The tumor did not invade the full thickness of the duodenal wall. The common duct and the pancreatic duct entered the tumor in the superior portion of the ulcerated area through separate openings. (Fig. 4.)

The postoperative course was satisfactory. Jaundice cleared slowly to a normal level. Replacement therapy with desiccated ox bile and pancreatin was used for three months postoperatively. The patient gained from 117 to 148 pounds. The small segment of catheter placed in the pancreatic duct passed spontaneously about two months postoperatively. The T tube was removed three months postoperatively. The patient was living and apparently well nine months after surgery.

The operation performed in this case is not to be recommended in that a complete resection of the head of the pancreas and total duodenectomy were not performed. The operation was selected because of the patient's age and poor condition and because grossly the lesion involved the mucosa only without evidence of further spread.

COMMENTS

Both of these cases presented obstructive jaundice early in the course of the disease with anemia and occult blood in the gastrointestinal tract. This combination of signs should lead the clinician to suspect carcinoma about the ampulla. Impacted ampullary stones do not usually produce bleeding and in carcinoma of the head of the pancreas blood loss and anemia are more likely to be late results of extension. These cases are of interest in that they call attention to the relatively long period that may elapse between onset of symptoms and definitive surgery with an operable lesion being found at surgery. In Case I the interval was twenty-two months; in Case II the interval was twenty-one months. Other cases presenting long intervals between onset of symptoms and definitive surgery have been reported.

Another point worthy of emphasis is that in both cases duodenotomy with direct visualization was necessary before the true nature of the lesion was recognized. In Case II duodenotomy allowed differentiation from a stone impacted in the ampulla and from a benign ampullary tumor. In Case I duodenotomy allowed differentiation from carcinoma of the head of the pancreas and from pancreatic fibrosis secondary to recurrent pancreatitis. The differentiation between carcinoma of head of the pancreas and carcinoma of the ampulla because of the similarity of the gross pathologic findings may be difficult unless duodenotomy is performed. The clinical importance of this differentiation is that the prognosis for carci-

noma of the ampulla of Vater is more favorable and radical pancreaticoduodenal resection is strongly indicated. The prognosis for carcinoma of the head of the pancreas is less favorable and palliative surgery only may at times be accepted.

SUMMARY

1. The subject of carcinoma of the ampulla of Vater is briefly reviewed.

2. Two cases are presented in which the treatment was surgery.

3. Carcinoma of the ampulla of Vater may be operable many months after clinical onset of symptoms.

4. The value of diagnostic duodenotomy is emphasized.

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NEPHROCALCINOSIS

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GERACI, Harris and Keith[1] have called attention to bilateral diffuse nephrocalcinosis in a recent review of the subject, at the same time adding two new cases to the literature. In view of the apparent rarity of this condition as well as the tremendous interest in it today we wish to present two additional cases of diffuse nephrocalcinosis.

Bilateral calcification of the kidneys has been found with increasing frequency in various pathologic conditions but none of the reports to date have adequately explained its development; nor has any mention been found up to the present writing of the condition occurring in two members of the same family.[2–20] The precise mechanism of the pathogensis of this disease is definitely not completely understood. The various theories and the many contributing factors or predisposing conditions already incriminated in its development attest to the lack of fundamental knowledge of its actual development.

It is not the purpose of this paper to review the many existing theories of its pathogenesis nor to discuss the numerous factors already incriminated in its etiology. We merely wish to present two additional cases of diffuse nephrocalcinosis that occurred in two members of one family, a mother and an eighteen year old son. These are apparently the first two recorded cases of the condition occurring in two members of one family. Although no attempt is being made to explain this phenomenon, it is our confirmed opinion that the probabilities of chance are not a factor in this instance; and it therefore may be assumed that some familial or hereditary factor had some role in the development of the disease in these patients.

CASE REPORTS

CASE 1. A. S., a white female forty-five years of age, was admitted to the Hospital General San Felipe July 6, 1950, for the interruption of a four-month pregnancy. A definite diagnosis of diffuse bilateral nephrocalcinosis was made in 1948 by one of us (J. R. D.) when the patient was hospitalized in a private clinic because of severe left renal colic complicating a six-month pregnancy. X-rays taken at the private clinic as well as repeat x-rays taken at a later date at the present institution confirmed the diagnosis of left renal calculus but revealed at the same time the existence of diffuse bilateral nephrocalcinosis. Therapeutic abortion was performed by one of us (J. R. D.) in 1948 at the private clinic and sterilization was recommended but was refused.

The first definite indication of any abnormality or sickness was in 1938 when the patient suffered her first attack of left renal colic. Her health had been excellent until that time except for several minor bouts of malaria and the usual childhood diseases. This primary renal colic took place in San Salvador where she was taken to a local hospital for emergency treatment. Although no x-rays were taken at that time, the attending doctor made a diagnosis of left renal colic and advised surgery which was refused. The patient was discharged from the hospital after forty-eight hours. In spite of the given history of apparent good health further intensive questioning elicited the fact that in 1932 the patient had suffered from a similar but milder attack of left-sided lumbar pain following which she admitted passing a small, pea-sized "stone" in the urine. Prior to 1932, the exact interval of time not being remembered, and subsequent to 1938 the patient admitted passing urine containing varying amounts of gravel alternating with periods in which the urine was absolutely clear. While the gravel was passing, there was associated dull lumbar pain on the left side, the episodes lasting three to five days. On further questioning the patient admitted that her backache had followed the birth of her oldest child in 1925. Shortly thereafter she also noticed for the first time some frequency and polydipsia, which symptoms had been constantly present since then.

Since 1938 she had had several attacks of typical renal colic per year, always beginning on the left side. Each attack lasted from three

to five days, never varying. The initial severe pain was gradually replaced by a dull ache which spontaneously subsided to disappear eventually, even without medication. During the attacks the patient was quite restless and was unable to sleep or find a comfortable position in bed; she had intense thirst, marked frequency and urgency. The urine became scanty, dark colored, foul smelling and on standing developed a heavy granular sediment, sometimes being almost one-half of the excretion. At no time had the patient observed frank hematuria or any changes in the urine suggesting the presence of blood. In the intervals between the attacks she was absolutely well, able to perform her daily duties as a domestic and was very active.

A detailed history system by system revealed absolutely no complaints which were referable to the cardiovascular system. All manifestations of the illness were limited to the genitourinary system. The patient had three living children, twenty-five, twenty-one and eighteen years of age, respectively; she had had four miscarriages and one therapeutic abortion. Following the abortion her menses became irregular and scanty and she missed from two to three months on various occasions. Her last menstrual period was in April, 1950, the exact date not being remembered. There was no history of nephritis, arthritis, the ingestion of concentrated vitamin D or parahormone. The patient did not use milk or dairy products in excess. An item of possible interest was that from 1925 to 1938 the patient suffered from an "acid state" for which she used baking soda, up to 1 pound per day, stopping in 1938 when she realized that the drug was not relieving her gastric distress. Since then she had not used any drugs in any form outside of an occasional aspirin or proprietary headache powder.

Physical examination revealed a white female appearing somewhat older than the given age. There was evidence of some weight loss, slight dehydration and a dry, scaly skin. Blood pressure varied between 90 to 100 systolic and 62 to 70 diastolic for maximum and minimum during the entire hospital stay. Her pulse, respirations and temperature curves were all within the normal range. Except for slight tenderness over both kidney regions with reflex muscle spasm on punch pressure the entire examination was non-contributory. Pelvic examination confirmed a four-month pregnancy. Cystoscopic examination revealed chronic cystitis with edema of both ureteral orifices, more marked on the left side. This orifice was surrounded by several small ulcers. It was impossible to pass a No. 6 French ureteral catheter above a point 1.5 cm. from the ureteral orifice. The bladder capacity was reduced to about one-half of normal and no urine could be observed to pass from the left ureteral opening.

Fundoscopic examination revealed absolutely no pathologic changes. Visual fields were normal as were all the complementary eye examinations made. There was slight reduction in vision which was attributed to the patient's nutritional status.

Prior to surgery the patient was studied for one month in the hope of determining some etiologic factor. Various urine studies such as the Fishberg concentration test gave a constant specific gravity varying on one occasion from 1,012 to 1,018, the value remaining constant throughout the individual test. On all occasions the urine revealed the presence of pus in varying amounts; red blood cells varied from 20 to 40 per high power field at repeated examinations; the urine was always loaded with bacteria, but it was impossible to identify the predominant organism culturally. The sediment varied from sandy to frank gravel; there was a constant foul odor to the urine which was eventually controlled with antibiotics, at which time the bacterial content of the urine also disappeared to some marked degree. At no time were casts found in any specimen of urine examined. Studies of the chemical constituents of the blood, at least those tests which it was possible to perform here because of rather limited laboratory facilities, revealed the following: total serum proteins on two occasions 6.4 and 6.8 mg. with an albumin fraction of 3.5 and 4.1 mg. and a globulin fraction of 2.9 and 2.7 mg., respectively, in each instance per 100 cc. The concentration of serum sodium was 320 and 315 mg. on repeated tests ten days apart, of the plasma chlorides 500 and 530 mg., and the values for the blood urea on three occasions (twice at the same time as aforementioned tests) were 15, 18 and 22 mg. per 100 cc. The value for the serum calcium was 8 mg. per 100 cc. on the first test and 8.5 mg. per 100 cc. on the second. Total non-protein nitrogen, also on two tests, was 30 and 35 mg. per 100 cc., respectively.

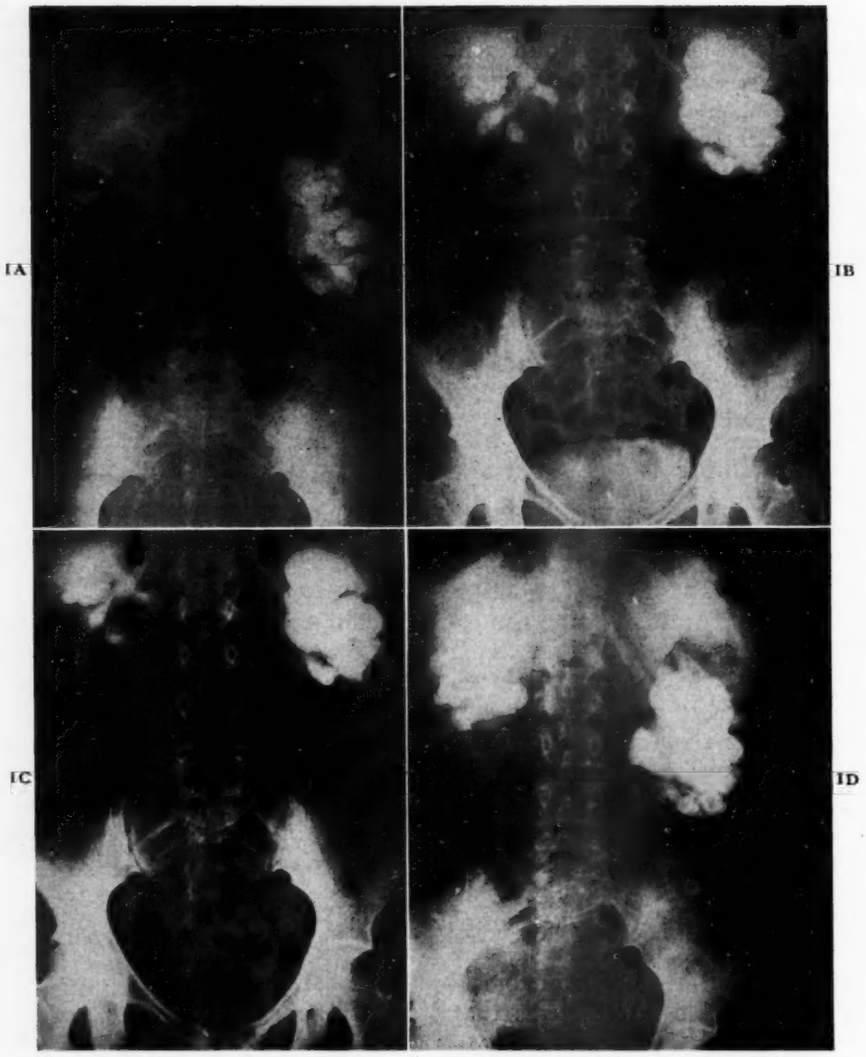

FIG. 1. Case 1. A, July 12, 1948, x-ray reveals total calcification of left kidney with two stones ½ by 1 inch in the right; uncomplicated five-month pregnancy. B, December 9, 1948, x-ray shows massive formation stones entire left kidney with two stones 3 by 1½ inches and 2 by 2 inches in the right; slight dilation right ureter. C, December 15, 1948, same as (B) with complete invisibility left ureter and deformity right renal pelvis. D, July 11, 1950, no change in left kidney from x-rays of December, 1948; partial function right kidney with apparently seven stones of varying size.

The first x-rays taken July 12, 1948, reported almost total calcification of the left kidney. There were two stones approximately ½ by 1 inch in size in the right kidney. There was an uncomplicated five-month pregnancy. A parathyroid dysfunction was to be considered. On December 9th there was massive formation of stones occupying the entire left kidney. There were two stones, 3 by 1½ inches and 2 by 2 inches, in the right kidney. There was slight dilation of the right ureter. On December 15th the left kidney revealed the same picture as that of the 9th. There was complete invisibility of the left ureter indicating total destruction of the renal parenchyma. There was deformity of the right renal pelvis with widening of the superior calyces. The upper one-third of the ureter alone was visualized. On July 11, 1950, with regard to the left kidney there was absolutely no apparent change from that reported December 15, 1948. It was obvious that there was total destruction of the renal structures on the left. The right kidney revealed only partial functioning. Approxi-

mately seven stones were seen on the right side giving a stag-horn appearance to the kidney. The exact size of the individual stones could not be determined. (Figs. 1 and 2.)

The hospital stay was absolutely uneventful. A bilateral hemisalpingectomy was performed by one of us (M. M. S.) on August 8, 1950. Later, after recovery from this operative procedure, therapeutic abortion was again performed by one of us (J. R. D.) on September 1, 1950. Treatment consisted of salt-poor diet, limited fluid intake and antibiotics to control the urinary infection. The diagnosis on discharge was bilateral diffuse nephrocalcinosis.

Case II. J. S. C. S., an eighteen year old white male, the youngest son of patient A. S. (Case 1), was admitted to the hospital's outpatient department for study because of chronic pain in the right lumbar region. The patient stated that the pain had been present almost constantly since he was ten years of age.

Prior to that time a similar pain had been present differing only in that it was intermittent, dull and dragging at its onset at the age of six. This pain gradually progressed becoming identical with the pain for which the patient came to the hospital. He was at time of admission never free of the pain which became much worse when he lay on his back. The pain frequently awakened him from his sleep. It radiated to the pubic region where it localized over the urinary bladder, but there was never any radiation into the testicle or penis. He had never complained of hematuria nor had he noticed any blood in the urine. His urine was absolutely clear, without any variation in color or odor, and there was no sediment present on standing. There had been some frequency, nocturia of four to six times and marked polydipsia. As in the first case, there was no history of nephritis, arthritis, overdosage with vitamin D or parahormone medication. The patient also stated that since infancy he had had an unusual appetite for baking soda, using large quantities of the drug in his food in place of salt or sugar. He began using this at the age of six and did not stop until he was sixteen. His only reaction to the excessive use of this item was that it acted as a purgative producing two or three semi-solid stools daily.

Systemic examination revealed the presence of generalized headaches lasting from two to three days which were relieved by the use of aspirins or similar drugs. The patient noticed

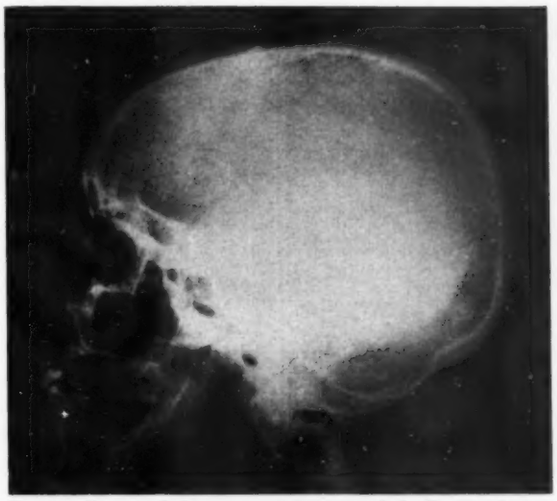

Fig. 2. Case 1. July 11, 1950, x-ray of skull reveals no decalcification.

gradual impairment of vision, being unable to distinguish objects over 25 feet away.

Physical examination was absolutely noncontributory. The patient was well developed, with blood pressure varying from 100 to 84 systolic and 60 to 70 diastolic; pulse, respirations and temperature were within normal limits at all times. Cystoscopic examination revealed mild cystitis with normal filling and emptying of the bladder. The ureteral orifices were patent, not dilated and revealed no abnormality. The ureters admitted a No. 5 French catheter without difficulty, slight resistance being encountered high on the right side. Fundoscopic examination revealed grade II nearsightedness. Otherwise all other ocular examinations were normal.

The patient was subjected to the same study as his mother. Identical examinations were performed on both and differed only in that the former patient was studied as an outpatient whereas the latter was an inpatient. Various urine studies such as the Fishberg concentration test gave a constant specific gravity, varying on one occasion from 1,020 to 1,024, the value remaining constant at each instance for the three readings. On all examinations the urine revealed the presence of 5 to 10 red blood cells per high power field; there was no pus and epithelial cells were found on only three examinations. The urine did not contain an abnormal number of bacteria considering that the specimens were not catheterized. It was of normal color and odor showing only a few mucus shreds in the sediment. There was no

FIG. 3. Case II. X-ray July 30, 1950, reveals presence of five various-sized stones in right kidney varying from ½ by ½ inch to 1½ by 1½ inch.

gravel or sand. Studies of the chemical constituents of the blood revealed the following: total serum proteins varied from 7.4 to 8.0 mg. with an albumin fraction of 5.8 and 6.1, and a globulin fraction of 1.6 and 1.9 mg., respectively, on two consecutive tests. The concentration of serum sodium was 310 mg. per 100 cc., also on two tests ten days apart, of the plasma chlorides 550 and 600 mg. per 100 cc., and the values for the blood urea were 15 mg. per 100 cc., identical values being obtained in the two tests performed. The values for the serum calcium were 9.0 mg. per 100 cc. on the first test and 8.5 mg. per 100 cc. on the second. Total non-protein nitrogen was 25 mg. per 100 cc. in the single test performed.

The x-ray report rendered on July 30, 1950, revealed the presence of five various-sized stones in the right kidney by retrograde pyelograph. These stones varied from a size of about ½ by ¼ inch to the largest measuring approximately 1½ by 1 inch. There was minimal dilation of the renal pelvis with normal contours of the calyces. The ureters were not dilated. There did not seem to be any marked degree of renal damage. (Fig. 3.)

Surgical removal of the calculi of the right kidney was recommended as a precautionary measure although there would be no assurance that recurrence or further progress of the disease would not occur. When last seen the patient steadfastly refused to submit to operation and had not followed the routine of treatment outlined previously for his mother.

COMMENT

Case I presents a really remarkable picture considering the duration of the disease, the extent of kidney calcification and functional loss resulting therefrom, with so little clinical evidence of renal insufficiency. The slight changes in the blood chemistry, the comparative excellent state of health of the patient, her resistance to two pregnancies within a period of two years and many other similar items are hard to explain in view of the existing pathologic condition. From the history of the case, the definite lack of specific chemical abnormalities in the blood as found in other specific syndromes producing nephrocalcinosis plus the constant urinary findings of pus, etc., point to an old pyelonephritic infection as the probable causative agent in this case.

Case II is unusual in that renal calculi were present in the son of a parent who unquestionably had increased calcium in the blood during her gestation although this point cannot be proved at this time. The duration of symptoms, the paucity of symptoms resulting from the presence of kidney stones for this length of time as well as the relatively normal blood chemistry make the pathogenesis of the condition in this instance rather obscure. We have assumed that there must have been some transference of the hypercalcemia present in the mother at the time of pregnancy via the placental tissue and its circulation to the child.

Whatever the factors involved in these two cases there must be a combination of a disturbed renal tubular function with variations of tissue alkalinity and alkalosis to produce sufficient precipitation of calcium salts in the renal parenchyma so as to cause the phenomenal changes observed.

SUMMARY

Two additional cases of diffuse nephrocalcinosis occurring in a mother and son are presented. The physical findings, clinical symptoms and biochemical changes were minimal in both instances although the pathologic changes were very marked and extreme in the case of the mother and moderately advanced in

the case of the son. No attempt has been made to explain the pathogenesis in these two cases.

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SUBMUCOUS LIPOMA OF THE STOMACH*

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IN an excellent review of the literature Rumold[11] in 1941 collected thirty-four cases of gastric lipoma and added one of his own. Since then ten additional cases have been reported.[1–6,9,10,12,13] While benign tumors of the stomach are in general uncommon, lipomas are unusually rare constituting less than 0.06 per cent of all gastric tumors.[4]

In view of its infrequent occurrence the following two cases of gastric lipoma are presented.

CASE REPORTS

CASE I. A. B., a seventy-one year old obese white female, entered St. Joseph's Hospital on May 3, 1950, with the chief complaint of epigastric pain of several years' duration. The pain was recurrent, colicky in nature and radiated into her back. The last episode occurred one week previously and was accompanied by nausea and vomiting. After the colic was relieved, the epigastric discomfort persisted. The patient was unable to tolerate rich foods and pork. On May 1, 1950, she passed several black liquid stools. The physical examination was essentially negative except for the presence of some tenderness in the right epigastrium. No mass was palpable in the abdomen. The hemogram was as follows: hemoglobin, 14.5 gm.; color index, 1.0; red blood cells, 4,600,000 per cu. mm.; white blood cells, 4,330 per cu. mm., with 8 per cent stab neutrophiles, 53 per cent segmented neutrophiles, 31 per cent lymphocytes, 1 per cent monocytes and 2 per cent eosinophiles. Urinalysis showed a slight trace of albumin and occasional red and white blood cells per high-powered field. The sedimentation rate was 60 mm. in one hour.

Roentgenologic study of the stomach revealed a large defect in the pars pylorica. (Fig. 1.) The duodenal bulb was normal and no gastric retention was seen on the four-hour film. The impression of the roentgenologist was, "A carcinoma or ulcer with a large inflammatory mass." The Graham-Cole test failed to visualize the gallbladder on two attempts.

A laparotomy was performed on May 5, 1950. Under inhalation anesthesia the abdomen was entered through a left upper quadrant oblique incision. The stomach was found to be free of malignancy. However, there was a lipoma about the size of a hen's egg in the gastrohepatic ligament on the lesser curvature of the stomach near the pylorus.

Palpation revealed this tumor was dumbbell in shape; the other portion extended into the submucosa of the stomach as a bulging mass. The patient's gallbladder was distended and filled with many small calculi. The incision was extended past the midline and her gallbladder was removed. The lipoma was then dissected free from the gastrohepatic ligament and the stomach wall. The intraluminal portion was dissected away from the overlying mucosa with some difficulty. The gastric serosal defect was repaired and the abdomen closed in layers with a drain to the cystic duct stump.

The tumor measured 8.5 cm. in length and 3.5 cm. at its greatest diameter. Microscopic study showed it to be composed of well differentiated adult adipose tissue. The overlying gastric mucosa was normal in character.

The patient's convalescence was protracted by the development of pulmonary atelectasis on the twelfth day but on the eighteenth postoperative day she was discharged.

CASE II.* M. A., a fifty year old white female, entered St. Michael's Hospital on February 1, 1950, complaining of a cramping, "biting" pain in the epigastrium for the past month. The pain occurred after each meal and was accompanied with nausea and vomiting. The emesis was noted to be brown, "like coffee grounds" on several occasions. A week

* The authors are indebted to Dr. James Morgan for supplying the clinical material in Case II. The patient was operated upon at St. Michael's Hospital, Milwaukee, Wis.

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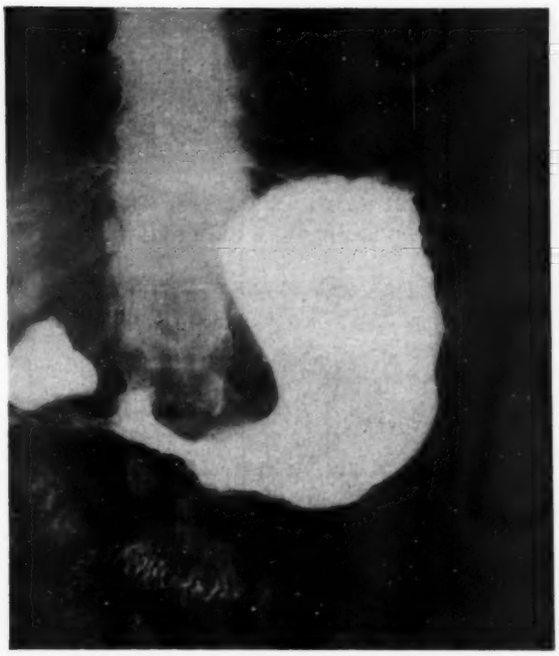

FIG. 1. Roentgenogram of Case I showing the large, rounded, punched-out defect in the pars pylorica of the stomach, suggestive of a benign lesion.

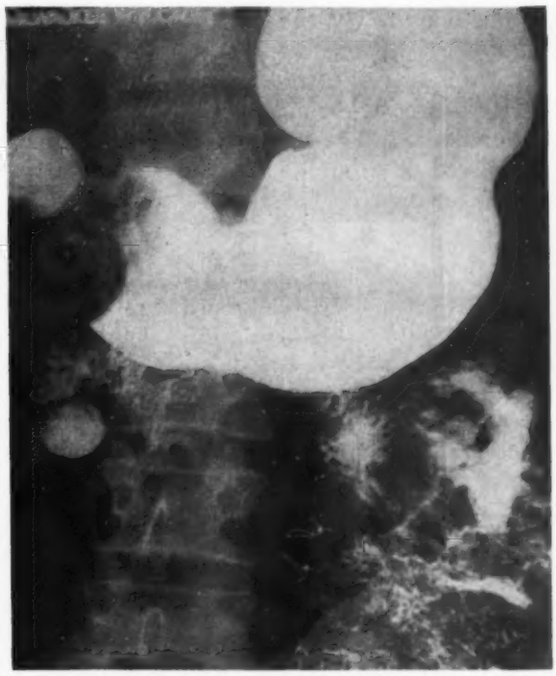

FIG. 2. Roentgenogram of Case II demonstrates the rounded, punched-out filling defect in the pars pylorica; a diverticulum is seen in the second portion of the duodenum.

before hospitalization the patient developed diarrhea and passed bright red blood in her stools. She was always tired and easily fatigued. Past history revealed a two-stage resection for carcinoma of the hepatic flexure of the colon, with an ileotransverse colostomy in 1948.

The patient was well developed and well nourished and her physical examination was essentially negative. There was some tenderness in the epigastrium but no mass was palpable. Two surgical scars were present on the abdomen. The hemogram was as follows: hemoglobin, 10.5 gm. (63 per cent); color index, 0.9; red blood cells, 3,390,000 per cu. mm.; white blood cells, 7,800 per cu. mm.; 1 per cent stab neutrophiles; 74 per cent segmented neutrophiles; 23 per cent lymphocytes; 1 per cent monocytes and 1 per cent eosinophiles. The sedimentation rate was 20 mm. in one hour and the total protein was 6.16 gm. per cent with an A/G ratio of 1.3/1.

A barium meal study on February 4th showed a small diverticulum at the distal third of the esophagus. The stomach was in good position, modified steerhorn in type and had good tone. There was a large defect in the pars pylorica. (Fig. 2.) A diverticulum protruded from the second portion of the duodenum. A four-hour film revealed 2 per cent to 3 per cent gastric retention and diagnosis of gastric carcinoma was entertained by the roentgenologist. Colon studies on February 6th showed a well functioning ileotransverse colostomy.

On February 22nd after transfusions and supportive therapy the patient was taken to surgery with a preoperative diagnosis of carcinoma of the stomach, possibly a metastasis from the previously resected colon carcinoma. On entering the abdomen through a right paramedian incision many adhesions were encountered. Examination of the stomach showed an intramural lipoma in the anterior wall of the pylorus. This tumor lying in the submucosa protruded into and partially occluded the gastric lumen. Further inspection revealed an indurated mass below the right kidney. A section of this tumor taken for microscopic study proved to be adenocarcinoma. No metastatic nodule was visible or palpable in the liver. The gastric serosa was then opened by a linear incision and the lipoma resected from the gastric wall. The gastric defect was sutured and the abdominal wall closed without a drain.

The lipoma weighed 67½ gm. and measured 8½ by 4½ by 4 cm. It consisted of well differentiated adipose tissue.

Postoperatively the patient received blood, fluids and supportive therapy. On February 24th she developed precordial pain and irregularity of the pulse; digoxin and quinidine were administered. The patient recovered and was dismissed on March 11th, the sixteenth postoperative day.

COMMENT

Clinically, gastric lipomas are difficult to differentiate from malignant and inflammatory lesions of the stomach due to the similarity of symptoms produced. Although a high percentage of these gastric lipomas do not produce the alarming symptoms of hemorrhage or obstruction, the complaint of epigastric distress, anorexia, nausea and vomiting are common. Hematemesis and the formation of tarry stools from the hemorrhage produced by ulceration of the mucosa overlying the tumor are not uncommon. This bleeding may be massive and frequently chronic resulting in anemia, pallor and weakness. Intermittent pyloric obstruction and retention may result from the prolapse of a pedunculated prepyloric lipoma.[2,4]

Because of the rarity of these tumors the preoperative diagnosis, if made, depends upon the roentgenologist's ability to detect the few signs that differentiate them from malignancy. Moore[8] in a study of benign tumors of the stomach points out several roentgenologic features suggestive of these lesions. These tumors usually present a circumscribed, punched-out filling defect on the gastric wall leaving the curvature regular and pliant. Peristalsis is undisturbed and no niche, incisure or evidence of spasm is present. The adjacent rugae are obliterated as in malignant or inflammatory lesions. Retention is uncommon except in the case of a prepyloric tumor. On fluoroscopic examination Moore rarely found the tumor large enough to be palpable and the stomach walls to be in close approximation. Despite the presence of these features he believes an absolute differentiation can seldom be made on x-ray.[8]

Lipomas usually occur in the subserosa or submucosa and may project from one into the other as in Case 1. These tumors may vary in size from that of a cherry to an orange.[11] The gastric lipoma was found to be almost equally distributed between the sexes and the age incidence varied from twenty-nine to eighty-four years. The gross and microscopic features are similar to those of lipomas found elsewhere in the body.

Due to the location of gastric lipomas and the complications associated with them, surgery is frequently indicated. Resection of the tumor with a portion of the wall and mucosa has been recommended as the treatment of choice because of the possibility of malignant changes.[7,9]

SUMMARY

1. Two cases of gastric lipoma are presented. In Case 1 the symptoms were masked by coexistent gallbladder pathologic disorder and in Case 11 a coexisting recurrent carcinoma of the colon.

2. The clinical features of gastric lipomas are reviewed.

3. Up to this date forty-seven cases of gastric lipoma including two of our own have been reported in the literature.

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PRIMARY CARCINOMA OF THE FALLOPIAN TUBE*

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THE rarity of primary carcinoma of the fallopian tube prompts this report. Preoperatively the diagnosis is even more rare.[24] A greater familiarity on the part of more surgeons with this subject is desirable. Inasmuch as the disease is the most malignant of body cancers,[11,22] it should be kept in mind. Even though the preoperative establishment of the diagnosis is difficult, several authors have pointed out its feasibility.

Robinson[10] credits Raynaud with the original recording of the disease in 1847 and states that the pathologic disorder was first described by Rokitansky in 1861. A number of authors, however, including Martzloff,[12] Mitchell and Mohler,[13] and Stern and Hanley,[20] credit Orthman with the first adequate description in 1886.

Incidence. The reported incidence of primary tubal carcinoma varies from 0.16 per cent to 1.33 per cent of primary female pelvic malignancies.[9,10,14,22,23,24] An incidence of 0.5 per cent is probably an accurate over-all estimate[11,12,23] although two well controlled series[14,24] containing twelve and sixteen cases of primary tubal carcinoma present incidences of 0.16 per cent and 0.31 per cent respectively. The recognition of the case of Mitchell and Mohler and of the case of Greene and Gardner[19] of a preinvasive carcinoma of the uterine tube is suggestive of the impression of Stern and Hanley, however, that an increased number of sections of all tubes removed would undoubtedly result in a higher incidence.

Age. Age is a helpful factor in considering the symptomatology in this disease. The frequently quoted [11,14] figures of Wechsler indicate that two-thirds of his patients were between the ages of forty and fifty-five. Nine of the sixteen patients of Lofgren and Dockerty were past menopause and the majority of the patients reported by Hu et al.[24] were between forty and sixty-five years of age. Extremes of age from seventeen to eighty have been reported.[11,14,23,24]

Etiology. Etiologic agents have been suggested in the form of infection and chronic inflammation.[4,5,7,9,11,14] This relationship has been questioned by some authors[4,11,21,22] and evidence presented against the theory.[14,16] An association whether coincidental or not does exist, however, as is witnessed by the incidence of salpingitis in nine of twelve cases in the series of Hu et al. Lofgren found nearly 100 per cent incidence of subacute and chronic inflammatory changes in the so-called normal portions of tubes that were the seat of carcinoma. Sterility among patients of child-bearing age in a series of tubal carcinoma cases has been reported as 27 per cent.[24] At least three of the four cases of Kahn and Norris were sterile.[7]

Symptomatology. There are a group of symptoms that are fairly constant in the disease. Vaginal discharge of some kind is usually present. Ten of the sixteen cases of Lofgren and Dockerty complained of a discharge that varied in character from leukorrhea to bleeding and in one case was malodorous. Of 264 cases gathered from the literature by Martzloff[12] over half had a vaginal discharge. One-fifth of these were classified as leukorrhea whereas two-fifths were bloody and the remaining were watery or serous. Parsons, in discussing eight cases gathered from the Massachusetts General Hospital, states that the commonest finding was the onset of vaginal bleeding from three to twenty-two years after menopause. Six of this group of eight were past menopause.

Several warnings have been made in the literature regarding the indiscriminate use of radium in cases of vaginal discharge, especially when the bleeding or discharge has persisted following negative curettage.[6,9,11] Martzloff's preoperative diagnosis of a case of tubal carcinoma in 1940 was made on a patient with similar findings.

The syndrome of abdominal pain that is relieved by or disappears with the concomitant onset of a heavy vaginal flow, sometimes with the disappearance of a pelvic mass, has been described as hydrops tubae profluens.[9–11,14,21,24] Hu et al. reported one case fitting this descrip-

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tion and four of Parson's group presented these characteristics. It should be mentioned, however, that the existence of this syndrome depends not upon the presence of a tubal carcinoma but rather on the sealing of the distal end of the tube and on the presence of a secreting lining.[1] As Vest[21] points out, the symptoms of the two conditions may coincide. Further, as Mitchell and Mohler quote Hobbs, "In any serous or serosanguineous discharge from the cervix, three lesions are to be considered: (1) carcinoma of the uterus, (2) hydrops tubae profluens, (3) primary carcinoma of the fallopian tube."

In exactly half of the Mayo Clinic series (Lofgren and Dockerty) the symptom of pain of varying degree was present. Authors in the literature in general are in agreement that pain is an early symptom. In addition to descriptions of sharp and intermittent pain there have been reports of persistent and dull pain. The pain is usually related in location to the affected adnexal region but has also been noted to occur in the back. This has been thought to be due to direct extension of the neoplasm. Although Lofgren and Dockerty found no correlation with the common complaints of back ache, bearing down sensation, dysuria, increased frequency of urination and of constipation in their series, Anspach[6] cautions that these symptoms diagnostically speaking are important and are deserving of investigation.

Three of the cases of Hu et al. and an equal number of the series of Lofgren and Dockerty noted abdominal enlargement. This may be on a basis of tumorous enlargement or other pathologic changes in the tube such as a hematosalpinx. It has been pointed out, however, that other conditions such as uterine fibroids, chronic adnexal inflammation or cystic ovaries may be responsible for such enlargement.[24]

Physical Findings. As a rule, a palpable mass is present in one or both adnexal regions. This finding is important. The mass is movable in about one-half the cases.

Pathology. Accurate reporting of the pathologic condition is important if compilation of cases of primary tubal carcinoma is to prove of value.[2,4,12,24] The criteria set forth by Hu et al. are useful in this regard. They are as follows: (1) Grossly the main tumor is in the tube. (2) Microscopically, chiefly the mucosa should be involved and should show a papillary pattern. (3) If the tubal wall is involved to a great extent, the transition between benign and malignant tubal epithelium should be demonstrable.

Spread of tubal carcinoma may be by the lymphatics, blood stream or by direct extension and peritoneal implantation. The latter route is the most common.[20,21] It is the impression of Stern and Hanley that metastases occur late. The liver is not often involved. Metastases to the lungs are less common. It has been stated that closure of the fimbriated end of the involved tube occurs late in the disease[10,11] and that the protrusion of the neoplastic tissue offers an excellent means of peritoneal spread. Bilateral involvement of the tubes has been reported variously from 6 per cent[17] to over 33 per cent.[15,16,20] The percentage of bilateral involvement in the series of twelve of Hu et al. was 8.3 per cent (one case).

Prognosis. Survival rates have been discouragingly low and were reported as less than 4 per cent after three years.[6] More recently a 40 per cent five-year survival has been reported in one series.[24] Earlier diagnosis probably offers the most hope in improving the survival rates. Twenty years ago Anspach suggested more careful attention to complaints of pain and recommended more pelvic examinations with consequent earlier and more frequent diagnosis.

Treatment. In regard to treatment of these cases there is no marked disagreement in the literature. Total hysterectomy and bilateral salpingo-oophorectomy should be performed. Subtotal hysterectomy with bilateral salpingo-oophorectomy has been reported in a series,[18] however, and cases of apparent complete cure have occurred following simple salpingectomy.[19,21] In two of the three cases reported by Barrows[3] the treatment was conservative surgery. The results were uniformly poor with early fatal recurrence of the disease. Hill[23] suggests the possibility of retroperitoneal lymph node dissection. Roentgen irradiation postoperatively is carried out more often than not. It is regarded as a palliative measure by Hill, and Martzloff is also less than enthusiastic. Parsons, however, has suggested more vigorous therapeutic use of this weapon for, as he points out, the results cannot be made much worse and might be markedly improved.

CASE REPORT

The authors have recently had the opportunity to see a case of primary carcinoma of the fallopian tube and herein report their experi-

ence. The patient was a well developed and slightly obese white female of forty-nine years. Her chief complaint was relative to prolapse of the anterior vaginal wall with consequent dysuria, stress incontinence and back ache for a two-year period. She had six term pregnancies, a normal menstrual history and no previous surgery or serious illnesses. The patient had no vaginal discharge or abdominal pain. Laboratory work revealed a hemoglobin of 81 per cent, red blood count, 3,810,000 and white blood count of 7,900 with a differential of 72 neutrophiles, of which two were nonfilamented, and 28 lymphocytes. Urinalysis was reported as follows: specific gravity 1.014, sugar negative, albumin negative, red blood cells occasional, white blood cells negative and reaction acid. Kahn test was negative. The blood was Rh positive. Physical examination revealed a blood pressure of 178/90, pulse 90, respirations 24, temperature 99.2°F. and normal findings in regard to the heart and lungs. Moderate lower midline abdominal tenderness was present. No abdominal mass was palpable. The right adnexal region was slightly tender and presented a small but definite enlargement. The uterus was small and slightly retroverted. The perineum was very relaxed and presented a large cystocele and a rectocele of moderate extent. The cervix presented small lacerations and some evidence of cervicitis. On January 16, 1950, under intravenous sodium pentothal® curare anesthesia supplemented by nitrous oxide and oxygen, the cervix was cauterized and colpoplasty and colpoperineoplasty were performed. Following this the abdomen was opened through a midline suprapubic incision. A small amount of clear fluid tinged with red was encountered. The uterus and adnexas were normal to inspection and to palpation except for the right tube which was clubbed and enlarged to approximately 3.5 cm. and the fimbriated end was observed to be open. The color was a fleshy purple. There was no noticeable peritoneal involvement. The tube was removed in as gentle a manner as possible. Appendectomy was performed and the abdomen was closed in layers. Postoperatively the patient had a normal and satisfactory convalescence and was discharged on the seventh postoperative day. (Fig. 1.)

The pathologic report was as follows: Grossly, the fallopian tube measured 7.0 cm. in length and the distal two-thirds of the tube

FIG. 1. High power magnification; photomicrograph of fallopian tube showing the replacement of the mucosa by masses of anaplastic tumor cells.

was dilated to a maximum diameter of 4.0 cm. Cutting the tube revealed it to be filled with friable, pale, yellowish gray tumor tissue extending to the fimbriated end whose orifice was widely dilated by the tumor. The wall was very thin and the external surface was smooth.

Microscopically, section of the fallopian tube revealed the mucosa to be replaced by large irregular papillary masses of neoplastic cells which were columnar epithelium in type. In some areas the cells had a glandular arrangement. There was anaplasia of the nuclei and mitoses were present. The muscularis was thin and in a few areas the neoplastic cells extended into the serosa. In one section the transition of the normal tubal epithelium into neoplastic epithelium was noted. The diagnosis was adenocarcinoma of the fallopian tube. (Fig. 2.)

The patient was seen in the Department of Roentgenology where treatment under the following conditions was instituted: 250 kv., filtration: 0.44 Sn, 0.25 Cu, 1.0 Al (HVL 2.3 cm.), MA 15.0, beam size 15 by 15, FSD equal 50.0 cm., r/p.m. equal 30.80. Seventeen treatments were given starting February 20, 1950, and were completed March 15, 1950. There were two anterior 15 by 15 pelvic fields and two posterior 15 by 15 pelvic fields. Average dose was 200 r per field and there were two fields per day. Total dose in r per field was anterior fields, 1,700 r, posterior fields 1,500 r.

With no untoward symptoms or physical findings the patient was followed up closely in

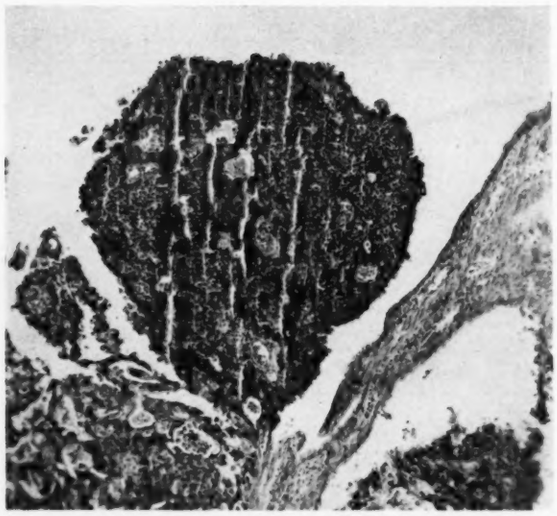

FIG. 2. Photomicrograph of fallopian tube showing the transition of tubal epithelium into neoplastic epithelium.

the office. In June, 1950, the presence of ascitic fluid was determined. Paracentesis was performed. Microscopically, no tumor cells were found. Paracentesis at increasingly frequent intervals became necessary and the patient was readmitted to the hospital on August 25, 1950, with abdominal distention and edema of both lower extremities. The clinical course was progressively downhill. She died September 3, 1950, a little over seven and a half months following excision of the neoplasm. Pertinent autopsy findings follow. Unless noted there were no metastases.

Examination of the abdomen revealed the subcutaneous fat in the midline measured 2 cm. in thickness. There were about 5,000 cc. of cloudy pale fluid in the peritoneal cavity. The parietal peritoneum was studded with numerous pale gray tumor nodules. The omentum was similarly studded with tumor nodules and was adherent to the parietal peritoneum. The serosal surfaces of the small and large intestines were covered with similar tumor nodules and loops of intestines were adherent to one another and to the parietal peritoneum. The diaphragms are studded with tumor nodules and the right leaf of the diaphragm is adherent to the surface of the liver.

Examination of the thorax showed the left pleural cavity contained about 3,000 cc. of pale cloudy fluid and the left lung was completely collapsed. The parietal pleura presented many friable yellowish gray tumor nodules. The right lung was free and the right pleural cavity contained only a small amount of cloudy pale fluid. There were no metastases in the right pleura.

Examination of the lungs revealed the left lung weighed 135 gm. Crepitation was absent throughout. Grossly there were no tumor nodules. The right lung weighed 380 gm. Crepitation was diminished in the lower lobe. The cut surface presented a firm, mottled, reddish gray appearance. The bronchi contained mucous. The large vessels were normal. Microscopically, there were no tumor nodules.

The liver weighed 1,650 gm. The capsule on the superior and anterior surfaces was adherent to the right leaf of the diaphragm which was studded with small yellowish gray nodules. The cut surface of the liver did not present any tumor nodules. The gallbladder was adherent to the omentum. There were no calculi and the bile ducts were patent. No tumor nodules were present in the parenchyma.

The spleen weighed 180 gm and was adherent to the left leaf of the diaphragm which was studded with tumor nodules. Its cut surface was firm and purple. Microscopically, no tumor cells were present.

Examination of the gastrointestinal tract revealed the serosa of the stomach, small and large intestines was studded by numerous small yellowish gray tumor nodules. There was no invasion of the wall and the mucosa of the gastrointestinal tract was intact. The root of the mesentery and the mesocolon was filled with tumor tissue. Microscopically, the serosa of the stomach and intestines was invaded by masses of neoplastic cells having a glandular arrangement. There was no invasion of the muscularis and the mucosa was normal in appearance.

Examination of the aorta revealed minimal atherosclerosis. The peri-aortic lymph nodes are enlarged to a maximum diameter of 2 cm. and filled with pale yellowish gray tumor.

Examination of the bladder and genital organs revealed the pelvic and parietal peritoneum was studded with numerous small grayish yellow tumor nodules. The right tube had been removed. Both ovaries were atrophic. The surfaces of the bladder, uterus, ovaries and left tube were studded by tumor nodules. The cervix and endometrium were normal. The bladder contained about 100 cc. of cloudy pale urine. The mucosa was normal. The microscopic sections of the uterus revealed the endometrium to be normal in appearance. The endometrial glands were tubular and lined by

regular columnar epithelium. The cytogenic stroma was dense. The serosa of the uterus was covered by neoplastic cells having a glandular arrangement. There were no notable morphologic alterations in the cervix. The serosa of the left fallopian tube was covered by similar neoplastic cells. The surface of the left ovary was also studded by similar cells. The right ovary was diffusely invaded by neoplastic cells having a papillary glandular arrangement. Areas of necrosis were present in this ovary.

COMMENTS

There are several interesting factors in this case that are worthy of repetition. This patient entered the hospital without significant delay after being seen by her physician for the first time. Yet, even though she presented none of the most typical symptoms that are usually described for the disease, the malignant process was far enough advanced so that salpingectomy and therapeutic irradiation, except possibly in palliation, was of no avail in influencing the final outcome.

In view of the contention by Martzloff that uterosalpingography is probably a harmless procedure, it should be pointed out that although it has been stated that in the majority of these cases the fimbriated ends are closed,[9] it has also been stated that sealing of the ends of these tubes occurs late in the course of the disease.[10,11] Reinforcing that opinion, there was no evidence in the case herein described to indicate even partial closure. The authors are of the opinion that if abdominal spread through the open ostium has not occurred spontaneously, examination of the patient prior to and at surgery offers an excellent opportunity for seeding of the malignancy.

It can be seen why a vaginal discharge is not necessarily essential to the diagnosis in this disease. It may be that only with the sealing of the fimbria will a significant discharge occur.

Opening tubes of a suspicious nature prior to completion of the operation has been suggested.[7,20] Such a procedure would, however, open the field to the possibility of surgical metastasis.

The chances that the general surgeon will come upon a case of tubal carcinoma are extremely small. On the other hand, there are a certain number of these patients who remain undiagnosed.[11] The possibility of an increased incidence of cases diagnosed too late in the course of the disease has been pointed out.[24] This increase was due to a relatively more conservative attitude toward the adnexas in recent years. In order to save life in a significant number of these patients more surgeons necessarily must be aware of the disease and its symptoms as well as of the accepted treatment. The surgeon and even the pathologist will add to the value of his reports by giving adequate attention to details and by having some regard for future correlation.

Whether or not the outcome of the case herein reported could have been changed is open to discussion inasmuch as the fluid present in the abdomen was a possible indication of spread and the open fimbriated end an indication of the means of spread. The autopsy findings support this attitude.

With these cases so scarce the variable factors at work will tend to obscure the results. Nevertheless, the future may see a significant improvement with the increased use of roentgen irradiation. The Wertheim operation could prove to be the biggest single factor tending to improve the survival rate. Perhaps the suggestion of Hu et al. regarding the possibility of radical surgery in any patient at or near the menopause with symptoms of adnexal disease should receive wider attention.

SUMMARY

1. The literature on primary carcinoma of the fallopian tube has been reviewed.

2. A case of primary carcinoma of the fallopian tube has been reported.

3. The desirability of wider general knowledge concerning this disease has been pointed out.

4. The variability in the sealing of the fimbriated end of the fallopian tube has been re-emphasized.

5. The variability of and the etiology of the vaginal discharge in cases of carcinoma of the fallopian tube has been discussed.

6. The inherent danger in diagnostic or surgical handling of a carcinoma of the fallopian tube has been discussed.

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OVARIAN PREGNANCY*

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ACCORDING to Stander[53] the recorded data on ovarian pregnancy has been traced to the seventeenth century when Mercerus and St. Meurice described such an occurrence. The first published case is generally attributed to Tussenbroeck of Brussels in 1899. Beginning with Williams' report in 1917 the cases have been intermittently reviewed on several occasions. This report deals with a twenty-year review of the English literature made with the intention of summarizing the clinical and pathologic data on acceptable cases. It was hoped that some clinical or pathologic pattern might be deduced from such a study. The following data results from the review of sixty-five cases of ovarian pregnancy reported in the English literature during the past twenty years. We have discarded sixteen of these cases because of the lack of pathologic examination and/or inability to fulfill the criteria of Spiegelberg. A rather significant number of these cases were advanced abdominal pregnancies which seemingly had arisen from the ovary but were implanted over adjacent areas so that the original site was indefinite.

It would seem pertinent to mention the criteria of acceptability under this portion of the discussion as the question frequently arises of abdominal pregnancy with implantation on or about the ovary. The criteria of Spiegelberg, formulated in 1879, have undergone little change. These requirements are as follows: (1) The tube on the affected side must be intact. (2) The fetal sac must occupy the position of the ovary. (3) The pregnancy must be connected to the uterus by the utero-ovarian ligament. (4) There must be ovarian tissue in the sac wall. The data then represent forty-nine cases which would appear acceptable.

Incidence. The frequency with which nidation occurs within or upon the ovary has been placed at one in 25,000 pregnancies by Courtiss.[6] He also stated that .94 per cent of ectopic gestations were ovarian. Kuzma[28] recorded three of 200 ectopic pregnancies as ovarian (1.5 per cent) and Gandy[17] recorded 0.7 per cent. The incidence of ectopic pregnancy as such varies between figures such as one in sixty-nine by Nucci[42] and one in 403 by Stander.[53] The incidence at Burlington County Hospital has been thirty-seven cases of ectopic pregnancy in 10,000 deliveries or one in 270. There has been one case of ovarian pregnancy or an incidence of 2.7 per cent of ectopic pregnancies in this institution. The reportedly authentic cases at various periods in the past thirty-two years are as follows: Williams (1917), forty-one cases; Wynne (1919), forty-two; Sutton (1924), forty-seven; Frank (1927), sixty-four; Strezoff (1927), ninety-two; Wollner (1932), forty-eight; Wilson (1941), fifty-nine; Thomas (1943), sixty-five; Novak (1943), sixty; Stamn (1946), eighty-five; and Wittenberg (1948), eighty-one.

The present case brings the total to fifty acceptable cases in the English literature of the past twenty years.

Etiology. The mechanism of ectopic pregnancy has not become entirely clear. The mechanism of ovarian pregnancy would seem even less clear. Two general categories have been defined by several authors, these being a primary or a secondary implantation. These groups have been defined according to the location of the pregnancy on the surface or within the substance of the ovary. The possible causes of implantation on the surface of the ovary have been mentioned as (1) rupture of deeply seated follicle into a more superficial follicle, (2) fertilization within an endometrial implant, (3) development within a Wolffian remnant and (4) peri-oophoritis causing a thickening of the tunic so as to prevent egress of the ovum. The foremost cause for secondary implantation has been mentioned as salpingitis with peri-oophoritis. In none of the cases reviewed was there a history of pelvic inflammatory disease. Jarcho[25] has reported 52.7 per cent of 129 cases of tubal ectopic pregnancy as showing salpingitis on histologic examination.

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The results of our review do not contribute to the question of etiology as no predisposing factors can be elicited. The reason for this may be found in the lack of detail of pathologic and operative data contained in the case reports.

Clinical Course. In 80 per cent of the cases in which the finding was noted there was a normal menstrual history. The age of the patients varied from nineteen to forty-four years, with the largest group falling between twenty-four and twenty-nine years of age. In eighteen or 44 per cent of the patients the interval between the last menstrual period and the onset of symptoms was less than twenty-eight days whereas in twenty-three or 56 per cent it was more than twenty-eight days. The largest group of patients, fifteen or 47 per cent of the cases, were operated upon after missing one menstrual period. The parity varied from I to VIII. The greater number of these women had never had more than two previous pregnancies and the greatest number were primiparous.

It is interesting to compare these data with that recorded in a series of tubal ectopic pregnancies. Jarcho[25] reported that tubal ectopic pregnancies occurred in nulliparous women in 37.6 per cent of his cases. Nucci[42] reported that 70 per cent of the patients in his series of tubal ectopic pregnancies had missed one or more periods. Jarcho[25] reported that 73 per cent of 173 patients had had amenorrhea prior to the establishment of the diagnosis of tubal ectopic pregnancy. TeLinde[56] believes that tubal abortion occurs as a rule between the sixth and twelfth weeks. It would appear that in approximately 73 per cent of ovarian pregnancies in which the finding was reported rupture occurred by the eighth week after the last menstrual period or by the sixth week of gestation.

Signs and Symptoms. The signs and symptoms are caused by the presence of a gradually enlarging pregnancy in the ovary which frequently ruptures. This gives rise to bleeding into the peritoneal cavity. As a result the patient may have abdominal pain, sometimes periumbilical or suprapubic, which occasionally radiates to the rectum or shoulder. In 84 per cent of the reviewed cases in which the presence or absence was stated, pain was present. There may be rigidity and rebound tenderness due to the peritoneal irritation and the patient may be pale or in shock depending upon the amount of blood lost. In approximately 52 per cent of the nineteen cases in which the operative findings were reported there was no free blood in the peritoneal cavity. Therefore, a significant number of these patients do not present signs of hematoperitoneum. On pelvic examination a mass, usually tender, can be found either in the cul-de-sac or adnexa. In the majority of cases there is acute tenderness on manipulation of the cervix.

Vaginal bleeding as in tubal ectopic pregnancies may or may not be present. In 65 per cent of the cases in which the presence or absence was stated vaginal bleeding was present. Nucci[42] reported in a series of tubal ectopic pregnancies that 92 per cent had abdominal pain. Vaginal bleeding or spotting was present in 70 per cent.

The laboratory work was presented in only six cases. In one case the white blood count was normal whereas in five cases it was elevated between 12,000 and 23,000. In five cases in which the Friedman test was done it was found to be positive. Jarcho[25] found 24.9 per cent of fifty-three tubal pregnancies as having positive Friedman tests. Because of the similarity of the signs and symptoms to tubal ectopic pregnancies the diagnosis is rarely made before operation when the ovary and oviduct can be inspected.

Operative Findings. There was free blood present in the peritoneal cavity in nine cases and no free blood in ten of the cases in which the finding was stated. The involved ovary occurred on the right side in sixteen cases and the left side in fifteen of the cases in which it was stated.

Treatment. The treatment, as in any ectopic pregnancy, is always operative either because of hemorrhage or because of the ever present danger of hemorrhage. The patients in whom severe hemorrhage and shock have occurred should be treated with blood transfusions until the blood pressure has been stabilized within normal limits for a reasonable period and then explored. As a rule the hemorrhage is readily controlled and the amount of anesthesia required is not excessive so that the patients tolerate operation satisfactorily.

Mortality. Of the forty-nine cases utilized in this survey all of the patients survived operation. There have been cases of supposed ovarian pregnancy in which a near term fetus has been delivered by laparotomy and the child has survived. There would seem to be some doubt

as to whether these cases were true ovarian pregnancies or abdominal pregnancies. In the latter cases a living child is not too rare. The mortality in 173 cases of tubal ectopic pregnancy reported by Nucci[42] was 2.6 per cent.

Pathology. The interesting pathologic features in this case are the absence of a fetus, the central location of the pregnancy and the absence of corpus luteum cells. A definite site or mode of implantation could not be determined. The rather deep location of the pregnancy and the absence of corpus luteum cells would suggest that the implantation was either interstitial or possibly a surface implant that had eroded deeper into the ovary. The latter might occur by virtue of the cytolytic power of the trophoblastic tissue. There was no evidence of endometriosis found in any part of the ovarian tissue. Neither was there any evidence of chronic inflammation or thickening of the tunica albuginea which might be responsible for delayed rupture of the follicle.

The presence of luteinization of the theca interna, although minimal, is interesting in that it is ordinarily associated with chorionepithelioma or hydatidiform mole. There was no evidence of neoplastic or degenerative changes found in the chorionic villi. The mild luteal hyper-reaction appears to have been caused by the proximity of the trophoblastic tissue to the developing follicles.

In the forty-nine cases reviewed we found that decidua was present in 50 per cent of the cases. An embryo was also present in 50 per cent of the cases in which this finding was reported. A corpus luteum was present in 75 per cent. This would suggest that implantation is associated with a ruptured follicle in most cases. Endometriosis and atretic follicles were each reported in only three cases, so that very little can be determined as to the part played by these factors in the etiology of ovarian pregnancy.

It is interesting to note that a case has been reported in which hydatidiform mole formation occurred. According to Novak[40] a case of eclampsia has been reported in ovarian pregnancy.

CASE REPORT

The patient, M. C., was a twenty-five year old white female, gravida III, para II, with both children living and well following spontaneous deliveries. Her menses had been normal prior to the onset of the present illness. Her last menstrual period had been November 24 to 29 1948, which was fifty days prior to admission to the Burlington County Hospital. She felt entirely well during December and did not believe herself pregnant when she skipped the December period. On January 4, 1949, she began to flow and continued until January 8th; however, spotting of dark red blood continued daily until the day of admission, January 13, 1949. Nineteen days after the last expected period and on the day of admission she was suddenly seized with sharp, severe pain in the lower abdomen and rectum while stooping to the floor. There was no accompanying disturbance of bowel or bladder functions. Her family doctor immediately sent her to the hospital. The remainder of her history was noncontributory. She was known to be intolerant to fatty food.

On physical examination she was a moderately obese young woman, crying and rolling with pain. Her blood pressure was 144 systolic, 65 diastolic; her pulse rate was 100 per minute and her temperature 99°F. She had diffuse and acute low abdominal tenderness with muscle guarding which was most pronounced suprapubically. Peristaltic sounds were normal. Pelvic examination revealed the cervix to be of a bluish hue with a dark brownish discharge in the cervical canal. Any movement of the cervix was acutely painful. The uterus was slightly enlarged and displaced to the left. The right adnexa was acutely tender and contained a mass of approximately 6 by 4 cm. The cul-de-sac was also acutely tender. Other positive findings included a small nodule in the left lobe of the thyroid gland.

Leukocyte count was 13,200, with 68 per cent neutrophils. The hematocrit was 35 volumes per cent. Urinalysis was within normal limits.

The impression was that the patient had a ruptured ectopic pregnancy. Approximately three hours after the onset of her illness she was prepared and taken to the operating room. Laparotomy was performed under endotracheal gas, oxygen and ether anesthesia. Her abdomen contained approximately 1,000 cc. clotted and fluid blood. The right ovary was the site of a freely bleeding tumor measuring approximately 7 by 4 by 4 cm. The rest of the pelvic organs including the salpinx on the affected side appeared normal. A salpingo-oophorectomy was performed and the patient returned to her room in good condition with a transfusion in progress.

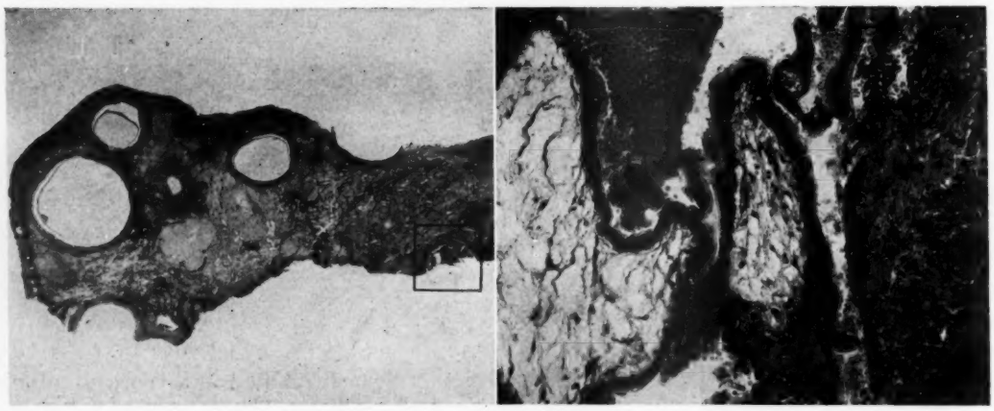

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FIG. 1. Low power view of a portion of the ovary; the frame surrounds the area of invasion by chorionic villi.

FIG. 2. High power view of area outlined in Figure 1; ovarian stroma is on the right and invading chorionic villi on the left.

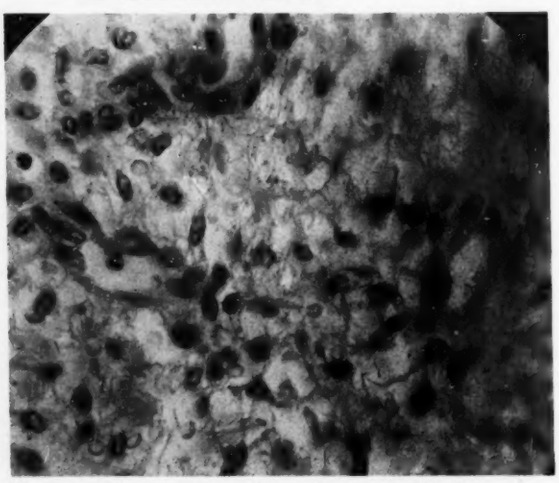

FIG. 3. High power view of decidua-like reaction within the ovarian stroma; this particular area lies distant to the site of invasion by chorionic villi.

The pathologic report was as follows: Grossly, the ovary measured 4½ by 4 by 3 cm. and was oval in shape and rubbery in consistency. The surface of the ovary adjacent to the line of excision for about 1½ cm. was yellow-gray in color and smooth. Tiny blue cysts and numerous petechial hemorrhages were seen beneath the surface. The remainder of the surface was dark purple in color, rounded with several firm elevations 5 to 15 mm. in diameter. These nodular elevations were rather friable and firm in consistency. The smooth surface was broken on the summit of one of these nodules by a rough hemorrhagic area. Otherwise the structure was well encapsulated.

On cross section the tissue was firm, rather friable and hemorrhagic. In the very center lay a cystic space 1½ cm. in diameter, filled with thin fluid and lined by a smooth gray membrane. Most of the remainder of the tissue consisted of numerous small spaces filled with clotted black blood which were separated by dark hemorrhagic tissue. In the area adjacent to the clamped tubo-ovarian ligament were several small cystic spaces filled with amber-colored fluid and lined by a smooth yellow-gray membrane.

The accompanying right fallopian tube was intact and uninvolved by the ovarian pathologic condition.

Microscopically, the stroma of the ovary was flattened by a large blood clot. Within the blood clot occasional small chorionic villi were seen with well defined syncytial and Langhan's layers. In sections taken from the tissue adjacent to the tubo-ovarian ligament typical cellular ovarian connective tissue was present in which germinal follicles and theca luteum cells were seen. The appearance was that of an ectopic pregnancy, unusual only in that it apparently occurred in the ovary. (Figs. 1 to 3.)

The patient's postoperative course was complicated by a brief episode of phlebothrombosis of the deep calf veins on the left side occurring on her eighth postoperative day. She was treated with dicumarol® and discharged on her fourteenth hospital day in good condition. Two weeks later she returned with an attack of cholecystitis. Cholecystogram revealed many radiolucent stones. A cholecystectomy was performed and the patient left the hospital on her twelfth postoperative day following an uneventful recovery.

SUMMARY

1. A case of primary ovarian pregnancy is reported along with the pertinent findings in a twenty-year review of the English literature on this subject. A total of sixty-five cases were reviewed of which forty-nine cases were considered sufficiently complete and authentic for study. Photomicrographs are submitted.

2. The symptoms, physical findings and laboratory and pathologic data of these forty-nine cases are summarized. These findings are compared with comparable findings in three series of tubal ectopic pregnancies.

3. It is hoped that this summary will contribute to an understanding of the clinical and pathologic picture of this entity. No significant etiologic factors were found. This is largely due to the incompletely reported pathologic and clinical data of many of the recorded cases.

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FATAL PULMONARY EMBOLI*

A STUDY OF 130 AUTOPSY-PROVEN FATAL EMBOLI

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A STUDY has been made of 130 cases of autopsy-proven fatal pulmonary emboli occurring at the Boston City Hospital during the years 1942 through 1949. Only those emboli believed to be the immediate cause of death were selected. This eliminated a large group of cases in which incidental pulmonary emboli were found which contributed only slightly to the fatal outcome.

The diseases predisposing to these fatal emboli are as follows: As was expected the cardiac and postoperative states were most frequently involved (forty-eight and thirty-three cases, respectively.) It was surprising to find that hemiplegia was the third most common disease state (twenty-two cases). Neoplasm (eleven cases), ambulatory phlebitis (eight cases) and miscellaneous diseases (eight cases) completed the series. It is of interest that no obstetric cases are represented in the series.

Each group of diseases was analyzed further with special attention given to the source of the emboli and the presence of leg signs whenever the leg veins were the source. Four sources were found and they were listed as leg definite, leg probable, heart and prostate. Each is self-explanatory except the leg probable group. This is a group of cases in which no source could be found in the heart or pelvis but an adequate examination of the leg veins was not made at autopsy. It is believed with certainty that most of these emboli came from the leg veins.

Cardiac Group. In this group of forty-eight cases the type of heart disease most commonly found was arteriosclerotic disease (twenty-four cases), with rheumatic and hypertensive disease following in order (thirteen and ten cases, respectively). Luetic disease was found in one case. The age distribution revealed that most deaths occurred in the seventh and eighth decades, with none before the third decade.

Age	No. of Cases
20–29	1
30–39	3
40–49	6
50–59	5
60–69	13
70–79	12
80–89	8

The source of the emboli is revealed in Figure 1. The leg veins were definitely involved in twenty-three cases and probably involved in fifteen. The heart was the source in nine cases and prostatic plexus of veins in one case. Leg

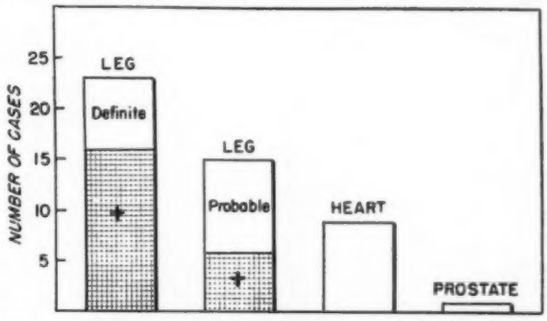

FIG. 1. Source of fatal pulmonary emboli in cardiac group. Boston City Hospital series. (Cross hatching denotes positive leg signs.)

signs were present prior to the embolus in twenty-two of thirty-eight cases (58 per cent) in which the legs were involved. Three of these patients had been treated with anticoagulants.

Postoperative Group. The age distribution in this group of thirty-three cases is similar to the cardiac group. Most deaths occurred in the seventh or eighth decades, with none before the third decade.

Age	No. of Cases
20–29	1
30–39	0
40–49	2
50–59	2
60–69	13
70–79	12
80–89	3

* From the Boston City Hospital, Boston, Mass.

The source of the emboli is demonstrated in Figure 2. The leg veins were definitely involved in twenty cases and probably involved in twelve cases. The heart was the source in only one instance. Leg signs were found in eighteen

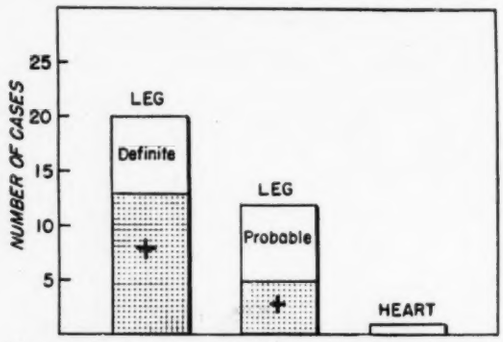

FIG. 2. Source of fatal pulmonary emboli in postoperative group. Boston City Hospital series. (Cross hatching denotes positive leg signs.)

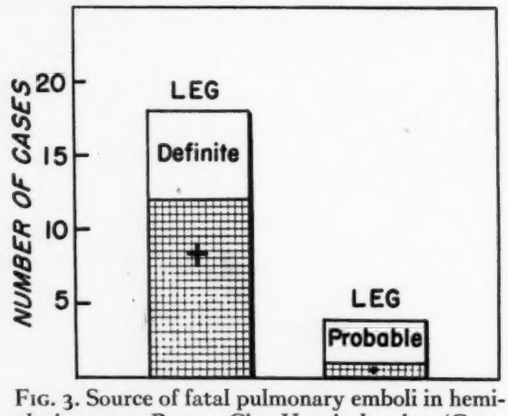

FIG. 3. Source of fatal pulmonary emboli in hemiplegia group. Boston City Hospital series. (Cross hatching denotes positive leg signs.)

of the thirty-two cases (fifty-six per cent) in which the veins were thought to be involved.

The postoperative day on which the fatal embolus occurred was investigated. All the emboli took place before thirty-three days and most before sixteen days. The distribution curve was even from the first day upward.

No correlation could be found with operative or postoperative shock. Hemoglobin of 80 per cent or lower was found in eighteen of the thirty-three cases.

The operations ranged from cranioplasty to hip nailing but the majority involved the large bowel and pelvic genitourinary system.

Five patients had surgical interruption of the femoral veins. Two of these were unilateral superficial femoral divisions performed in 1942. It was the experience with these failures that convinced our service of the inadequacy of unilateral interruption. Three patients had bilateral superficial femoral division and in one of these the fatal clot came from the deep femoral vein. In the other two cases the fatal embolus appeared to arise from the proximal stump of the femoral vein.

Hemiplegia Group. The age distribution of this group of twenty-two cases reveals that most of the emboli took place in the seventh and eighth decades, with no deaths occurring before the fourth decade.

Age	No. of Cases
30–39	1
40–49	0
50–59	4
60–69	6
70–79	9
80–89	2

The source of the emboli (Fig. 3) was the leg veins in every case, with eighteen being definite and four probable. Leg signs were present in thirteen of the twenty-two cases (60 per cent). The leg signs were either those of acute phlebitis or of the postphlebitic state (edema, varicosities, pigmentation). In every case the paralyzed lower extremity was the source of the embolus.

The hemiplegia was improving to some degree in fourteen of the twenty-two cases. In no case was the diagnosis of pulmonary embolus entertained prior to autopsy.

One patient received dicumarol® therapy and one had a unilateral femoral division performed after the pulmonary embolus had occurred.

Neoplastic Group. The site of the neoplasm varied greatly and can be listed as follows: stomach two, colon three, esophagus, liver, urinary bladder, lung and brain. There was one case of leukemia.

The leg was definitely the source of the emboli in eight cases and probably the source in three cases. Three patients of the eleven (27 per cent) had leg signs prior to death.

One patient underwent bilateral superficial femoral vein division but from the record it appears that the fatal embolus occurred before the surgery.

Ambulatory Phlebitis Group. This is a group of ambulatory patients with or without manifest thrombophlebitis who dislodged fatal emboli. In most of these the clinical impression of the cause of death was either pneumonia or coronary occlusion. Eight such cases were found.

The source of the emboli was the leg veins

definitely in six cases and probably in the remaining two cases. In five cases there were leg signs prior to death.

One patient had had bilateral superficial femoral vein interruption at another hospital one year prior to death. The operative note was obtained and the operator definitely stated that he had interrupted the vein and transfixed it with a silk suture. At autopsy the interrupted site had fully recanalized and the fatal embolus came from a leg vein.

Miscellaneous Group. The diseases found in this group of eight cases are as follows: leg infection two, senile psychosis two, amputation stump one, gastric ulcer one, femoral fracture one, and transverse myelitis one. The legs were definitely the source of the emboli in seven instances and probably in the remaining case. Two patients had positive leg signs.

COMMENTS AND CONCLUSIONS

In this series the source of the emboli was the leg veins in the great majority (91 per cent) of cases and in most of these (53 per cent) positive leg signs were present prior to embolization. These cases all occurred while vein interruption or anticoagulant therapy was available at the hospital. Therapy was attempted in only eleven of these cases. There is still a great need to emphasize that prompt recognition of the phlebitic state with immediate treatment of it will present many a needless death from pulmonary embolus.

Hemiplegia was the third most frequent disease predisposing to fatal pulmonary embolus in this series. This was an unexpected finding as it had not been previously emphasized in the literature. In no case in this group was the clinician suspicious of the embolus as a cause of death. In every case the paralyzed extremity was the source of the embolus. It thus behooves physicians caring for such patients to be suspicious of phlebitis whenever there are signs of acute phlebitis (tenderness over deep veins, edema, dilated superficial veins) or postphlebitic syndrome (edema, varicosities, pigmentation) in the paralyzed extremity. Prompt surgical interruption of the femoral veins may prevent the untimely death of such patients.

Surgical interruption of the femoral veins was performed in eight cases in this series. The reasons for the failure of these procedures to prevent embolus were studied and may be grouped as follows: (1) Three of the patients had only unilateral interruption. It was the experience with two of these early in 1942 that demonstrated for us the inadequacy of this procedure. (2) One patient in the neoplastic group had bilateral interruption which was performed after the fatal embolus had been dislodged. (3) In one case it appeared as if the fatal clot came from the deep femoral vein after a bilateral superficial femoral division had been performed. This raises the question of superficial versus common femoral division. It is our opinion that whenever the deep veins are found to be involved at operation or when there are extensive thigh signs of phlebitis the common femoral veins should be divided. (4) Two cases appeared to throw fatal emboli from the proximal femoral vein stumps after bilateral superficial femoral vein divisions and represent complete failure of surgical therapy. (5) One patient in the ambulatory phlebitis group had bilateral superficial femoral vein interruption at another hospital one year prior to death. At autopsy the interrupted site had fully recanalized and the fatal embolus came from a leg vein. We had a clinical case of a thirty-six year old woman who had had a bilateral superficial femoral vein interruption three years prior to entry for recurrence of phlebitis. Since no adequate explanation of the recurrence could be found, the femoral veins were re-explored. This exploration revealed complete recanalization of the superficial femoral veins at the site of the previous interruption. These cases emphasize the fact that ligation of veins is not sufficient to prevent embolization for any length of time. The proper surgical interruption must be a *division of the veins with removal of a segment of the vein.* Only this can prevent recanalization. This fact must be considered whenever statistics are being evaluated demonstrating the frequency of emboli after surgical treatment.

SUMMARY

1. One hundred thirty cases of autopsy-proven fatal pulmonary emboli have been studied at the Boston City Hospital.

2. Ninety-one per cent of these came from leg veins and the majority of these had positive leg signs for phlebitis.

3. Hemiplegia was the third most frequent predisposing disease.

4. Eight cases had some form of surgical interruption of the deep veins to prevent embolization. The reasons for the failure of these interruptions have been examined.

VALUE OF PARENTERAL NUTRITION IN THE POOR RISK SURGICAL PATIENT*

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IT has been recognized for many years that nutrition plays an important role in the care of the sick individual. Wangensteen[1] has emphasized that surgeons have been remiss in meeting the caloric and nitrogen requirements of their patients, during recovery from operations, having been abetted in this dereliction by those who have emphasized repeatedly that temporary periods of starvation are well withstood.

Although a person can survive a temporary period of starvation, there is no good reason why it should be imposed upon him, particularly if nutrition can be provided. Evidence is being rapidly accumulated to indicate that nutrition plays a factor in the healing of the sick individual.

Previous studies[2–4] have indicated the value of parenteral nutrition in the surgical patient as a substitute or as a supplement when adequate nutrition could not be provided orally. It was demonstrated that a group of patients who received no morphine but who were given glucose and alcohol intravenously presented fewer complications and sequelae than another group who received morphine and were fed only in accordance with their ability to consume food in the postoperative period.

Behan,[6] in discussing the value of intravenous alcohol for postoperative sedation, had mentioned the use of a mixture of glucose, amino acids and alcohol in a marasmic child. He should, therefore, be given credit for being the first to recognize the nutritive value of this mixture.

The recovery of the poor risk patient causes the surgeon his greatest concern. Aside from other associated diseases of the heart, lungs and kidneys, the greatest factor contributing to the poor risk of a patient is probably due to the complications and sequelae incident to his state of poor nutrition. In a state of poor nutrition there may be a loss of water, electrolyte, protein, carbohydrate and vitamin stores each with its associated sequelae. It is the common practice to endeavor to correct part of these deficiencies with the administration of glucose and saline or blood and plasma transfusions. These corrections should, of course, be done but it is not enough that only the blood, electrolytes and water disturbances be corrected. It is important that all of the nutritional requirements be provided.

It should be required of every hospital routine to keep track of the caloric balance during hospital illness, as it is now required to record the fluid balances. Unless adequate calories are provided from extraneous sources, carbohydrate, protein and fat reserves will be consumed from within the body. Furthermore, it has been our observation that electrolyte imbalances occur less often and can be corrected more readily when the nutritional requirements of the patient are fulfilled.

Parenteral nutrition can be resorted to when adequate nutrition cannot be consumed. It has been shown[4] that a mixture of glucose, amino acids and alcohol† given parenterally in the postoperative patient has been able to provide essentially the full caloric and metabolic requirement. Electrolyte and vitamin requirements can also be given parenterally.

Many of the factors which contribute to a state of poor nutrition can be found in varying degrees in the patient who suffers from stomach or bowel disease. It is in these that the poor risk patients are so often encountered. It is also in these patients that oral nutrition cannot be consistently maintained because of the need for interrupting the digestive activity of the gastrointestinal tract for a few days after operation. Therefore, it was decided to analyze the results which have been obtained in such a group of patients in order to determine whether or not those patients who were supplemented with parenteral nutrition did better than a similar group whose nutrition was provided

† Travamine.

* From the St. Barnabas Hospital, Minneapolis, Minn.

only in accordance with their ability to eat or with the administration of glucose and saline.

All of these patients had either a gastric or colon resection with primary anastomosis.

They were found at operation to be suitable for resection and primary anastomosis of the local lesion.

Patients consecutively operated upon have been chosen in each group but inoperable or palliative procedures have been excluded in the series of consecutive selection. No bad risk patient was otherwise excluded from the series. These patients fall into the following diagnostic groups:

Diagnosis	Group A	Group B
Diverticulitis of the sigmoid	1	2
Carcinoma of the colon	30	20
Gangrene of the bowel	None	2
Carcinoma of the stomach	3	4
Gastric or duodenal ulcer	12	16
Total	46	44

For the purpose of this study a more accurate localization of the lesion or histologic diagnosis seems unnecessary. Penicillin, streptomycin, aureomycin and the sulfa drugs were used singly or in combination in all patients. The surgical technic used in the operations was comparable in each group.

Early ambulation is an accepted procedure by all the surgeons at St. Barnabas Hospital and, therefore, all patients were encouraged to be ambulant as soon as they desired. Forced ambulation was not practiced.

The method of analysis was as follows: The patients were divided into two groups. Group A consists of patients wherein a deliberate effort was made to provide the full nutritional, caloric, fluid and electrolyte requirements of the pre- and postoperative period. This was done by supplementing with the parenteral administration of glucose, amino acids and alcohol in sufficient amount to cover the metabolic requirements. Vitamins B and C or B, C, D and E (pan vitamins) were used in all cases. The daily average caloric balance for the entire period of study was determined from the square meters of body surface as has been described previously.[3] The daily average nitrogen balance was determined in a considerable number of cases in group A.

Three days before operation oral feedings were discontinued in group A in order that the gastrointestinal tract might be empty of food residue thereby making a cleaner gastrointestinal tract. Surgery is therein facilitated. Parenteral feedings were continued postoperatively until it was thought that danger would not result from allowing food to pass over the newly anastomosed stoma. Thereafter, the patient was allowed to take food; but if inadequate food was consumed, parenteral feedings were supplemented.

For the most part, the patients in group B were given intravenous glucose and saline postoperatively until they were able to eat. No consideration was given for the caloric intake. The caloric balance was based on an average caloric requirement of 2,400 calories. The height and weight of these patients was not consistently recorded and, therefore, the metabolic requirements could not be accurately calculated. The caloric balance was determined in all instances by computing the caloric intake against the caloric requirements.

It was desired to illustrate objectively the difference in the two groups of cases in order to exclude subjective opinion. The objective factors have been listed in Table 1.

The insignificant weight change during the period of hospital stay, as illustrated in group A, indicates a state of maintained nutrition. Adequate information in this regard could not be obtained from the records in group B. It has previously been shown that patients will lose 8 to 10 pounds within a week in the postoperative period when they receive nutrition only in proportion to their desire to eat.

The difference in the caloric balance of group A and group B is significant. The nitrogen balance for sixteen patients in group A averaged +3.5 gm. per day.

Nitrogen balance studies were not conducted in the cases of group B. It has been shown previously that nitrogen balance was found to be negative almost invariably when the caloric balance fell below 70 per cent, unless the nitrogen intake was great.[3] In order to keep an average patient on the 70 per cent caloric balance it would be necessary to give 4,000 cc. of 5 per cent glucose and amino acids. This would be difficult to accomplish in twenty-four

hours and the fluid intake would be undesirably excessive.

The patients showing no complications experienced an entirely uneventful postoperative course. This is substantiated by the relative absence of fever throughout the entire post-

TABLE I

Item	Adequate Nutrition Group A	Inadequate Nutrition Group B
	Average	Average
Age	55	54
No. of males	28	25
No. of females	18	19
Admission weight	140.4	n/r
Discharge weight	139.2	n/r
Preoperative days' preparation with supplemental feeding	5.1 days	1.7*
Postoperative days of supplemental feeding	5.0 days	4.0
Caloric balance during supplementary period	92%	21%
Nitrogen balance (16 cases)	+3.5	n/r
No. of cases without complications	38 (83%)	28 (64%)
No. of cases with complications	8† (17%)	16† (36%)
Postoperative day of ambulation in uncomplicated cases	4.5	5.1
Maximum postoperative temperature in uncomplicated cases	100.5	100.7

* Two patients in Group A and twenty-five patients in Group B received no preoperative preparation.

† All complications listed in Table II.

operative period which in no instance exceeded 102°F. and averaged for the group a maximum temperature of 100.5°F. in group A and 100.7°F. in group B. These maximum temperatures usually occurred on the first postoperative day.

All manner of complications or associated sequelae have been included in the list of complications. Eighty-three per cent of the adequately nourished patients presented no complications whereas only 64 per cent of the inadequately nourished patients had no complications. In other words, in approximately twice as many patients who were inadequately nourished complications developed as compared to those who were more adequately nourished. These are detailed in Table II.

Although not identical, the list of complications in both groups is similar in that pulmonary complications, wound breakdown, intestinal obstruction and thrombotic manifestations are common to both groups.

The case of M. K., age sixty-nine, seemed remarkable in presenting an uneventful postoperative period in that the initial risk appeared to be very grave. He entered the hospital in apparent good nutrition, giving a history of having had intermittent abdominal distress for two weeks prior to his admission. This had been associated with diarrhea, anorexia and weakness. The abdominal distress became more severe four days prior to his admission. The abdomen became distended twenty-four hours before admission although the pain had ceased rather suddenly.

Physical examination revealed marked abdominal distention. Tenderness was evident throughout the abdomen but was more marked on the right side. X-ray showed air under the diaphragm and in the peritoneal cavity. The distribution of gas in the colon suggested that an intestinal obstruction existed in the colon and that the colon was ruptured. An immediate operation seemed urgent. At operation the peritoneal cavity was found filled (1 L., estimated) with liquid feces. A rupture of the ascending colon was found. A carcinomatous mass was palpated in the sigmoid to account for the obstruction. The peritoneal cavity was then thoroughly washed with warm water until gross evidence of contamination had been removed. The site of the colon rupture was brought out through the wound, producing a colostomy. The peritoneal cavity was then closed without drainage.

Streptomycin, aureomycin and penicillin immediately were used postoperatively. Throughout the entire postoperative period he was fed parenterally by the subfascial route because his veins were inaccessible. Glucose, amino acids and alcohol were instilled under the fascia lata of the thighs. Alidase was used for the purpose of hastening the rate of absorption. Oral feedings were given on the second postoperative day but this was inadequate for full caloric maintenance. The caloric balance was maintained at approximately 140 per cent. The convalescence was entirely uneventful. Maximum temperature elevation of 100.4°F. was reached on the second postoperative day.

For three days prior to the second operation no food was given by mouth in order that the gastrointestinal tract might be as free from

fecal content as possible. Subfascial nutrition with glucose, amino acids and alcohol was continued.

The second operation was performed ten days after the first operation. The peritoneal cavity was found clean and presented no evidence of peritonitis. The carcinoma of the sigmoid was removed along with a portion of the invaded bladder. A primary end-to-end anastomosis was done. A suprapubic drain was left in the repaired bladder. The patient received parenteral nutrition alone or as a supplement over a period of approximately twenty-four days. Food was allowed in each instance on the second postoperative day, but the oral intake was inadequate for the full metabolic requirement. He lost only 6 pounds during his hospital stay. His wounds healed by primary intention. The first postoperative period seemed the most critical in that an extensively contaminated peritoneal cavity was found in association with the perforated colon and distended bowel. The prognosis in perforation of the colon due to carcinoma is extremely grave.[7]

The second operation was likewise major in that a portion of the bladder had to be removed as well as a segment of the sigmoid colon. The only singularly significant factor in the care of this patient seemed to be the high nutritional intake that was consistently maintained throughout the entire postoperative period.

TABLE II

Group A				Group B			
Case	Complication	Maximum Temperature (°F.)	Fate	Case	Complications	Maximum Temperature (°F.)	Fate
J. D.	Extensive metastasis, peritonitis, hydrothorax	103.2	Died	C. F.	Abscess-ileus	103.4	Recovered
				M. M.	Wound infection, abscess, right leg	103.6	Recovered
G. C.	Thrombophlebitis	103.2	Recovered				
M. O.	Postoperative ileus	102.4	Recovered	T. H.	Subdiaphragm abscess	104.4	Recovered
W. C.	Intestinal obstruction, wound breakdown, reoperation	103.2	Recovered	M. N.	Atelectasis	100.4	Recovered
				L. L.	Atelectasis	101.6	Recovered
				J. S.	Atelectasis	102.0	Recovered
G. B.	Senile, wound separation	103.0	Recovered	R. B.	Atelectasis	103.0	Recovered
T. P.	Postoperative cardiac decompensation	103.0	Recovered	M. C.	Atelectasis	102.0	Recovered
				L. A.	Pneumonia	101.6	Recovered
A. A.	Atelectasis	102.6	Recovered	N. A.	Pneumonia	104.0	Died
A. P.	Diabetes, renal shutdown	102.1	Died	N. J.	Pulmonary emboli, wound drainage	102.0	Recovered
				A. I.	Pneumonia	104.2	Recovered
				C. W.	Thrombosis, infarct	101.4	Recovered
				K. T.	Wound drainage	100.0	Recovered
				A. J.	Wound separation, resutured	100.6	Recovered
				E. N.	Intestinal obstruction reoperation	101.0	Recovered

COMMENTS AND CONCLUSIONS

Adequate nutrition plays an important role in the smooth convalescence of the surgical patient. In the poor risk patient, who is usually also in a state of poor nutrition, it is additionally important that adequate nutrition be provided. This can be done easily by supplementing the oral feedings with parenteral feeding.

Parenteral nutrition with glucose, amino acids, alcohol, vitamins and electrolytes can supplement for the deficit which exists in the pre- and postoperative period in patients who cannot consume adequate food by mouth. This may be done either intravenously or subfascially.

To date, eighty-five patients in the St. Barnabas Hospital have received their parenteral nutrition subfascially using glucose 5 per cent, amino acids 5 per cent, alcohol 5 per cent, invert sugar 10 per cent or a combination of these. Sixty of these received invert sugar alone. No untoward reactions have resulted. Further details of the subfascial administration of nutrition shall be dealt with in a subsequent publication.

The two series of cases herein studied in which the only significant difference in their care was the nutritional intake indicate that some patients whose nutrition is inadequate can recover without complications (64 per cent). This was to be expected. However, this does not support the opinion of those men who champion the procedure of providing only glucose and saline or proctoclysis in the pre- and postoperative preparation of poor risk patients. There are too many other unavoidable factors which contribute to the complications in surgical patients to allow us to disregard the value of nutrition. The series of patients whose nutrition was adequately maintained presented fewer complications (17 per cent) than a similar series whose nutrition was inadequate (36 per cent).

Although it may seem that the incidence of complications in these two series of cases was high, it must be remembered that all of these patients were initially high risks, incident to their disease. A gastric or colon resection may be considered one of the most major surgical operations and would be expected to carry a higher incidence of complications than is found in less major surgery. A previous analysis[5] of several hundred general surgical cases, studied with a different purpose in mind, revealed 17 per cent of complications in a group of poorly nourished patients as compared to 1 per cent in a more adequately nourished group. Therefore, it would appear that better nutrition throughout the postoperative period, whether in the good risk or in the bad risk patient, does play a factor in diminishing the incidence of complications. If the intravenous avenue of parenteral nutrition is not available, the subfascial route may be used. When adequate parenteral nutrition is provided in the postoperative period, the patient's admission weight will be maintained. This should serve as a fairly accurate clinical index of the patient's state of nitrogen balance.

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MULTIPLE PRIMARY MALIGNANT TUMORS INVOLVING THE COLON AND RECTUM*

REPORT OF NINETY-FOUR CASES

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SINCE Billroth[1] published the first report of multiple primary malignancy in 1869, this entity has stimulated considerable interest among many investigators. Until recently multiple primary malignant tumors have been classified among the rare conditions in medical literature. During the past ten years the reported incidence of this entity has increased rapidly, owing to the ever increasing knowledge in the diagnosis of malignant neoplasms.

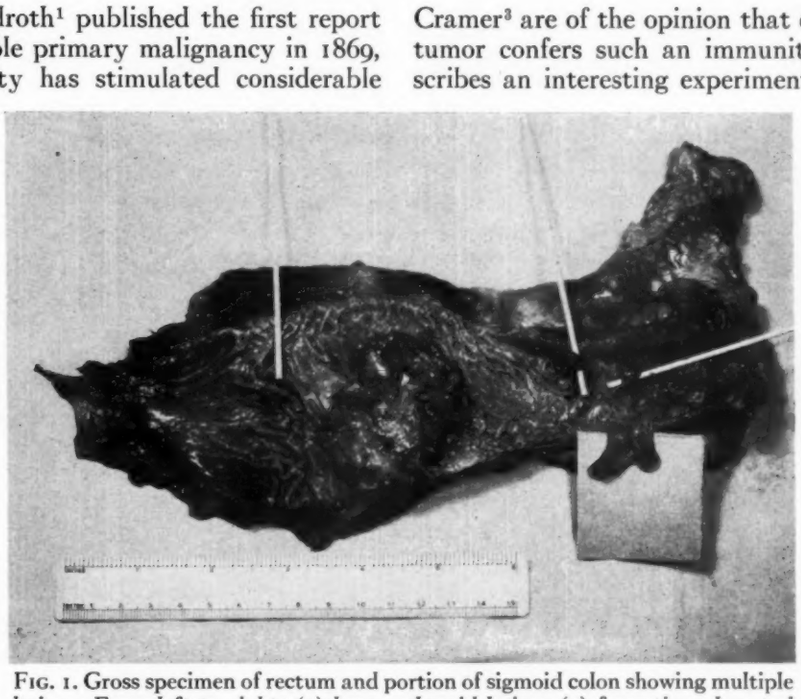

FIG. 1. Gross specimen of rectum and portion of sigmoid colon showing multiple lesions. From left to right: (1) large polypoid lesion; (2) fungating ulcerated frank cancerous lesion; (3 and 4) two polyps at end of pointers; (5 and 6) below, two more polypoid lesions.

FACTORS OF IMMUNITY, INHIBITION, HEREDITY AND SUSCEPTIBILITY

A number of investigators have theorized as to whether or not one malignant growth has an inhibitory effect on the development of other primary malignant neoplasms in the same individual. Lockhart-Mummery,[18] Dukes[2] and Cramer[3] are of the opinion that one malignant tumor confers such an immunity. Dukes describes an interesting experiment in which he transplanted neoplastic tissue from a malignant tumor site to a healthy tissue site in the same animal. The growing implanted tumor brought about the disappearance of the original tumor site. Greene[4] describes fifty-five cases of multiple primary tumors in a colony of rabbits over a seventeen-year period. He found that although one neoplastic focus neither predisposed toward or against the formation of another, the presence of one focus did exert an inhibitory effect on the progress of the other in its development to cancer. (Fig. 1.)

Warren and Gates,[5] Slaughter[6] and others[7] believe that one primary malignant neoplasm does not confer an immunity against another in the same individual. Lombard and Warren[7] in

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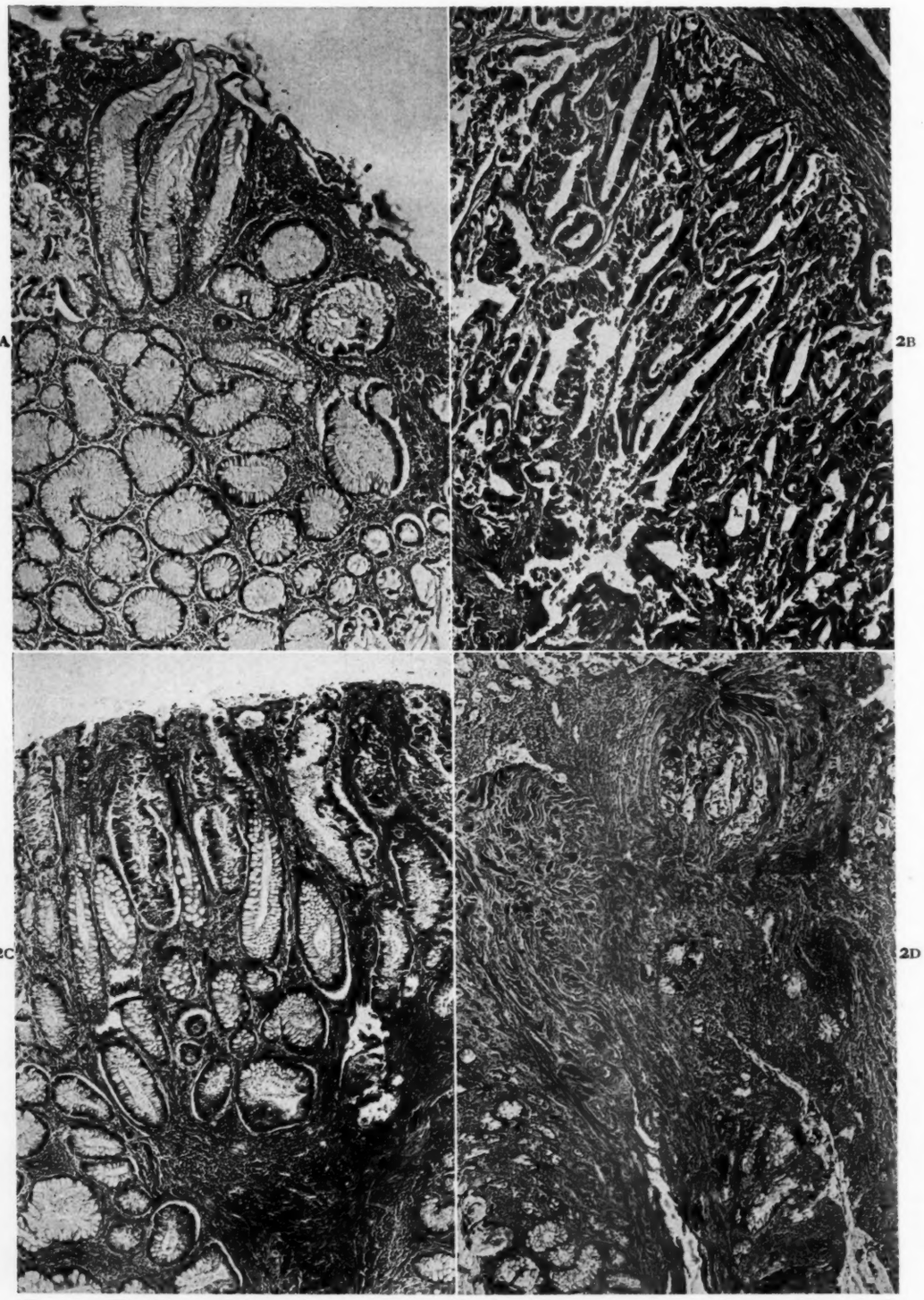

FIG. 2. A, The histopathology of the transition of benign adenoma to adenocarcinoma. Microscopic section of the large polypoid lesion, showing benign adenomatous proliferation of relatively uniform glands lined by tall cylindrical goblet cells. There is some hyperchromatism at the tip but no pleomorphism, mitotic activity or invasion. B, microscopic section of the large fungating and ulcerating lesion taken through the bowel wall to show invading neoplastic glands, lined by pleomorphic and hyperchromatic tall columnar cells, indicating adenocarcinoma, grade II. C, section of one of the polypoid lesions near the proximal end of the specimen to show polypoid adenoma with atypism. Here the glands are more dilated and somewhat irregular. The lining cells in many areas are pseudo-stratified and hyperchromatic. The dark cells near the base are shrunken lymphocytes. D, final section to show early invasive adenocarcinoma; this section includes mucosa and submucosa. Small groups of glands are seen invading the muscularis mucosa.

1943 published the incidence of multiple primary tumors in a controlled group. A second primary cancer subsequently developed in 117 of the 1,990 patients with cancer who were observed in a Massachusetts program. The calculated expected number on the basis of probability would be no more than eighty-five. Hurt and Broders[8] studied a series of 2,124 patients in whom a diagnosis of malignancy was made. Two years later a review of these patients showed that another primary lesion had developed in seventy-one cases. This represented an incidence of 3.34 per cent. The investigators concluded that the presence of one cancer did not confer an immunity upon the patient but, on the contrary, patients with one cancer are more prone to have another than are those who have never had a cancer.

Maude Slye[9] has shown in mice that spontaneous cancer is inherited as a mendelian dominant characteristic. Hurt and Broders[8] found a significant family history of cancer in 44.4 per cent of patients with multiple primary malignant neoplasia, and Stalker, Phillips and Pemberton[10] noted a similar family incidence of 26.6 per cent.

RELATIONSHIP OF ADENOMATOUS POLYPS TO MALIGNANCY

Many authors have pointed out that adenomatous polyps of the colon and rectum bear definite relationship to carcinoma of these organs. In fact, there are some[11,12] who believe that the histogenesis of carcinoma finds its sole source in adenomatous polyps. Laurens and one of us[13] studied a personal series of 800 cases of carcinoma of the colon and rectum in which ninety carcinomas (11.25 per cent) definitely had their origin in a benign adenomatous polyp. There were thirty instances (3.75 per cent) in which a similar origin could be presumed. Berson and Berger[14] found sixteen multiple cancers in 344 cases of cancer of the large intestine. Of these sixteen patients, six (37.6 per cent) had coexisting polyps and of the six patients with polyps 67 per cent showed malignant degeneration. In a group of 171 consecutive specimens of the rectum and sigmoid colon which were operated upon for cancer Broad and one of us[15–17] found polyps in fifty-four instances (31.2 per cent). Of the fifty-four cases of coexisting polyps eleven (20.3 per cent) were malignant.

The picture in the same surgical specimen of multiple lesions such as frank adenocarcinoma, benign adenoma, adenomatous polyp with atypism at the tip and a polyp with areas of frank carcinoma with invasion of the stalk leads one to consider, along with Lockhart–Mummery and Dukes,[18] that the simple adenoma whether single or multiple eventually shows malignant characteristics and that it is one stage in the development of cancer. (Fig. 2A to D.)

CASES OF MULTIPLE PRIMARY MALIGNANCY

In 1939, one of the authors[19,20] cited a group of ten patients with multiple primary malignancy. (Table 1, 1 to 10 inclusive.) Following a lapse of ten years the same author reported an additional forty-nine patients from a personal series of 800 patients with cancer of the anal canal, rectum and colon, representing an incidence of 6.1 per cent. (Table 1, 11 to 59 inclusive.) Five patients in this group (Table 1, 11 to 15 inclusive) were cited in collaboration with Gass.[21] During the thirty-one-month period from September, 1948, to May, 1951, an additional 312 patients with malignancy of the large bowel were observed, representing a total of 1,112. One of the authors (M. C. T.) in a review of this group of 312 patients found thirty-four (10.8 per cent) multiple primary cancers. (Table 1, 60 to 94 inclusive.) If the initial ten cases are excluded, eighty-four instances of multiple primary malignancy in a personal series of 1,112 patients remain; an incidence of approximately 7.5 per cent.

This last group of thirty-four cases is particularly interesting inasmuch as there are twenty-nine synchronous multiple primary tumors involving the colon and rectum. This emphasizes the need for a thorough search in all patients with cancer for the presence of more than one malignant tumor. Also, within this group there are two cases with coexisting adenocarcinoma and sarcoma.

Coexisting Adenocarcinoma and Sarcoma. Although multiple primary malignant tumors in the same patient are being encountered with increasing frequency, the presence of adenocarcinoma in conjunction with sarcoma is rare indeed. In addition to the eight cases collected from the literature (Table 11), we wish to report two from our own group.

TABLE I

MULTIPLE PRIMARY MALIGNANCY

Case No.	Name	Age	Sex	Sites of Multiple Malignancies	Treatment	Case No.	Name	Age	Sex	Sites of Multiple Malignancies	Treatment
1	H. F.	53	M	Rectum; rectum	R	25	W. B.	32	M	Rectum; sigmoid	R
2	T. S.	83	M	Rectum; rectum	None	26	M. K.	60	M	Rectum; sigmoid	R
3	J. S.	77	M	Rectum; rectum; sigmoid	R	27	E. L.	52	F	Rectum; uterus	R
4	G. S.	37	M	Rectum; stomach	C	28	P. S.	57	M	Rectum; rectosigmoid	R
5	D. D.	41	M	Sigmoid; stomach	EL	29	B. F.	66	M	Rectum; sigmoid	R
6	J. D.	61	M	Sigmoid; lip	R	30	L. B.	52	M	Rectum; rectum	R
7	J. R.	72	M	Sigmoid; esophagus	G	31	M. S.	54	M	Rectum; rectum	R
8	H. B.	79	M	Rectum; nose	None	32	C. D.	29	M	Rectum; rectum	R
9	S. L.	80	M	Rectum; tongue	C; RA	33	J. J.	60	M	Rectum; rectum	R
10	S. Q.	50	M	Rectum; gallbladder	R	34	L. R.	49	F	Rectum; ovary	R
11	R. F.	52	F	Rectum; sigmoid	R	35	M. K.	62	M	Rectum; rectum	R
12	A. T.	67	M	Rectum; tongue	R; RA	36	A. G.	49	F	Rectum; rectum	R
13	M. M.	69	F	Sigmoid; breast	None	37	S. B.	59	M	Rectum; rectum	R
14	F.W.C.	30	F	Rectum; cervix	R	38	W. B.	24	M	Rectum; sigmoid	R
15	M. M.	38	F	Sigmoid; cecum	R	39	G. C.	65	F	Rectum; sigmoid	R
16	W. J.	35	M	Rectosigmoid; sigmoid	R	40	J. F.	23	F	Rectum; sigmoid	R
17	P. G.	41	F	Sigmoid; uterus; bladder	R	41	J. A.	66	M	Rectum; sigmoid; descending colon	R
18	G. G.	58	M	Rectum; sigmoid	R	42	S. S.	52	M	Rectum; sigmoid	R
19	W. G.	66	M	Rectum; sigmoid	R	43	F. F.	36	M	Rectum; rectum	R
20	E. C.	56	M	Rectum; sigmoid	R	44	W. V.	66	M	Rectum; rectum	R
21	A. L.	72	F	Rectum; breast	None	45	L. S.	66	F	Rectum; breast; transverse colon	R
22	H. K.	62	F	Rectum; sigmoid	R	46	L. I.	58	M	Rectum; sigmoid	R
23	E. W.	56	M	Rectum; sigmoid	R	47	W. P.	53	M	Rectum; sigmoid	R
24	E. A.	42	F	Rectum; descending colon	R	48	D. W.	66	M	Rectum; sigmoid	R

TABLE I (Continued)

Case No.	Name	Age	Sex	Sites of Multiple Malignancies	Treatment	Case No.	Name	Age	Sex	Sites of Multiple Malignancies	Treatment
49	I. W.	63	M	Rectum; rectum	R	72	I. G.	63	M	Rectosigmoid; sigmoid	R
50	L. L.	65	F	Rectum; bladder	R	73	F. P.	61	M	Rectosigmoid; rectosigmoid	R
51	I. A.	52	F	Rectum; sigmoid	R	74	C. L.	62	M	Rectum; rectum	R
52	D. W.	73	F	Rectum; sigmoid	R	75	B. F.	58	F	Rectum; sigmoid	R
53	A. C.	66	M	Rectum; sigmoid	R	76	J. L.	42	F	Rectosigmoid; breast	C
54	S. S.	52	M	Rectum; rectum	R	77	B. D.	44	F	Rectum; ovary	EL
55	H. W.	58	M	Rectum; sigmoid	R	78	N. B.	69	F	Rectum; uterus	EL
56	W. V.	66	M	Rectum; rectum	R	79	H. V.	61	F	Sigmoid; stomach	EL
57	F. McG.	55	M	Rectum; sigmoid; cecum	R	80	R. W.	42	F	Rectum; ovary	EL
58	T. S.	41	M	Rectum; bladder	R	81	W. C.	37	F	Rectum; ovary	R
59	G. J.	43	F	Rectum; sigmoid	R	82	E. D.	66	F	Rectum; cecum	R; EL
60	R. G.	56	M	Rectum; sigmoid	R	83	M. K.	43	F	Sigmoid; ovary; ovary	R
61	M. Q.	40	F	Rectosigmoid; sigmoid	R	84	D. A.	39	M	Cecum; transverse colon	R
62	E. S.	65	M	Rectum; sigmoid	R	85	W. M.	75	M	Rectum; ascending colon; transverse colon	R
63	J. B.	65	M	Sigmoid; sigmoid; sigmoid	R	86	J. J.	65	F	Rectum; pancreas; ovary	R
64	L. D.	53	F	Rectum; sigmoid	R	87	G. C.	78	M	Rectum; sigmoid	R
65	R. M.	65	M	Sigmoid; sigmoid; sigmoid	R	88	I. H.	72	M	Rectum; sigmoid	R
66	J. D.	58	M	Sigmoid; sigmoid	R	89	M. L.	65	F	Rectum; splenic flexure	R
67	F. F.	36	F	Rectosigmoid; sigmoid	R	90	G. M.	56	M	Rectum; sigmoid; ascending colon	R
68	E. L.	60	F	Rectum; transverse colon	R	91	E. T.	70	F	Rectum; sigmoid	R
69	J. K.	66	M	Rectosigmoid; sigmoid	R	92	W. S.	56	M	Rectum; rectum	R
70	J. D.	62	M	Rectum; rectum	R	93	S. S.	43	M	Rectum; sigmoid	R
71	L. S.	52	F	Sigmoid; sigmoid; sigmoid	R	94	J. S.	35	M	Rectum; sigmoid; transverse colon	R

R = resection; EL = exploratory laparotomy; G = gastrostomy; C = colostomy; RA = roentgen therapy

CASE REPORTS

CASE 79. H. V., a sixty-one year old white woman, was admitted to our service on November 30, 1949, complaining of cramping lower abdominal pain. She was first aware of this pain in July, 1949. Pain progressively increased in intensity, particularly after eating. There was no bleeding or change in bowel habit but there was a weight loss of 12 pounds in the preceding six months. A barium enema previous to admission revealed diverticulitis and sigmoidal polyps. The family history was noncontributory; past history revealed left oophorectomy in 1927 and hysterectomy in 1930. There had been no previous serious illnesses.

Physical examination was essentially normal except that sigmoidoscopic examination revealed a polypoid lesion in the rectosigmoid at 19 cm. Biopsy revealed adenocarcinoma grade 1. Laboratory studies showed serum chlorides, serum total protein, prothrombin time, urinalysis, blood sugar and blood urea nitrogen to be within normal limits. Hemoglobin was 11.7 gm. (76.1 per cent); white blood count, 14,800.

The patient was prepared for surgery during which time she was given 1,000 cc. of blood. Exploration revealed a firm angular lesion approximately 10 by 7 cm. which was found to occupy the mid-portion of the greater curvature of the stomach. On palpation it was ascertained that this lesion had rolled edges and a definite crater-like center which had apparently extended to the immediate vicinity of the greater omentum. A piece of tissue was removed from this area for microscopic examination. Further palpation of the stomach revealed a circumferential lesion at the cardio-esophageal junction. There were numerous, large, indurated nodes in the gastrohepatic omentum. Palpation of the sigmoid revealed the presence of numerous diverticuli. A cherry-sized mass was palpated in the rectosigmoid. In view of the findings this patient was deemed nonresectable and the abdomen was closed. The patient's postoperative course was uneventful. She was ambulatory in several days and was discharged from the hospital on the tenth postoperative day.

TABLE II

COEXISTING CARCINOMA AND SARCOMA

Author	Site and Type of Tumor	Site and Type of Tumor	Site and Type of Tumor
Warren & Gates[5]	Rectum; adenocarcinoma	Rectum; lymphosarcoma	
Landau[22]	Rectum; carcinoma	Breast; fibrosarcoma	Jaw; osteoma
Werner[23]	Rectum; adenocarcinoma	Uterus; fibromyosarcoma	
Nehrkorn[24]	Rectum; melanotic sarcoma	Uterus; carcinoma	
Dijkstra[25]	Rectum; spindle cell sarcoma	Gallbladder; carcinoma	
Bargen & Rankin[26]	Sigmoid; adenocarcinoma	Uterus; sarcoma	
Cashman & Cohen[27]	Rectum; adenocarcinoma	Cervix; sarcoma	
Schneider[28]	Rectum; adenocarcinoma	Cervix; sarcoma	
Bacon & Tavenner	Sigmoid; adenocarcinoma	Stomach; reticulum cell sarcoma	
Bacon & Tavenner	Rectum; adenocarcinoma	Uterus; rhabdomyosarcoma	

The pathologic report in brief stated that, "These cells are rather large with large, pale-staining nuclei and huge nucleoli. In some areas they seem to be arranged along a framework of reticulum." The diagnosis was lymphoblastoma of the reticulum cell type.

Comment. This patient presented an adenocarcinoma of the sigmoid. There were also two separate tumor masses in the stomach. One was a lymphoblastoma of the reticulum cell type; the other could possibly be another primary malignant lesion of the stomach but it is more likely a metastasis of the first or its origin.

CASE 78. N. B., a sixty-nine year old white woman, was admitted to our service on May 31, 1949, because of bleeding from the rectum, diarrhea alternating with formed stools, progressive fatigue and weakness, and a weight loss of 40 pounds.

Physical examination revealed an emaciated and dehydrated patient. There were occasional rales generalized in both lung fields. Blood pressure was 160 mm. Hg systolic and 80 diastolic. The abdomen disclosed slight distention but no tenderness. The liver was not palpable. A mobile mass was palpated in the left

lower quadrant; it was firm, irregular, nontender and extended three fingerbreadths above the symphysis. Pelvic examination revealed the uterus to be displaced anteriorly by the mass. Rectal examination evidenced a fungating, circumscribed friable tumor mass apparently adenocarcinoma 5 cm. above the anal margin. Bilateral ankle edema was apparent. Laboratory studies were within normal limits except for a hemoglobin of 7.2 gm. (46.8 per cent).

Diagnosis was adenocarcinoma of the rectum and probable ovarian carcinoma. During the course of the patient's preparation for surgery signs of partial large bowel obstruction developed. Exploration on June 15, 1949, revealed the liver to be free of metastases, a large cystic left ovary, a large myomatous uterus and probably extension of the rectal carcinoma into the pelvis. Only a transversostomy was performed.

The patient's postoperative course was fairly good and preparation was made for more definitive surgery. Operation was performed on July 6, 1949, at which time a large uterine mass the size of a volley ball was removed. A large cystic ovarian mass was excised. It had the gross appearance of carcinoma and had infiltrated the posterior wall of the bladder and broad ligaments and extended to the preaortic nodes. The rectal carcinoma could be palpated in the distal 10 cm. of the rectum. Following resection a sump drain was placed in the pelvis and the wound closed with alloy steel wire.

Postoperatively, the patient's general condition deteriorated rapidly to the time approximately one month following operation when she was discharged to a convalescent home. The pathologic report was as follows: "The specimen consists of three irregular moderately firm masses of tissue the longest of which measures 17 by 10 by 8 cm. Each mass has a thin capsule which glides readily over the underlying substance; the cut surface varies from a homogeneous white to a homogeneous tan color. The sections reveal an extremely pleomorphic malignant tumor. For the most part there are interlacing bands of neoplastic cells, lying in the connective tissue stroma. There are many spaces within the tumor, some of which contain eosinophilic material. One section shows unequivocal rhabdomyosarcoma." The diagnosis was mesodermal mixed tumor of the uterus.

Comment. A recent review of the literature by Palumbo et al.[29] revealed only twenty-two cases of rhabdomyosarcoma of the uterus.

COEXISTING PRIMARY MALIGNANCIES OF THE LOWER BOWEL AND FEMALE GENITAL ORGANS OR BREAST

Among the thirty-five women in the entire series fourteen had primary malignant neoplasia of the lower bowel with coexisting primary malignant tumors of the genital organs or breast. This number comprised 40 per cent of all the females in the series. The malignant lesions were most frequently found in the ovary which was involved in six patients or 17.1 per cent of all women in the series. There was one patient who had bilateral lesions of the ovary. The average age was fifty-two years. (Table III.)

These women were in the menopause or postmenopause age, except possibly one (age thirty-seven). The age of menopause varies with the individual; thus the age when the cessation of estrogenic hormone stimulation occurs is also variable. The relationship between the female sex hormones and carcinoma of the female genital organs and breast is generally appreciated. How much influence the ovarian hormone secretion had upon the development of another primary malignant lesion of the genital tract or breast in this series can only be surmised, but it does raise the question of the advisability of castration of female patients who have malignant lesions of the colon or rectum concurrently with the removal of the bowel lesion, at least in women of this age. In any event this would prevent subsequent development of carcinoma in the ovaries. In those patients who still have estrogenic hormone activity castration would eliminate the hormonal influence in the development of another cancer of the genitals or breast.

REASONS FOR INCREASE IN REPORTED CASES OF MULTIPLE PRIMARY MALIGNANCY

In general the reported incidence of multiple primary malignant neoplasms has been between 0.3 per cent and 6.8 per cent and seems to be increasing. Several factors contribute to the increase of reported incidence. One of the first has been the changed concept as to what constitutes a multiple primary malignancy. Billroth's original postulates held that (1) each tumor must have an independent histologic

appearance; (2) the tumors must arise in different locations; (3) each tumor must produce its own metastases. To these Mercanton[30] added a fourth in 1893, namely, following a surgical operation to remove the primary lesions the patient must remain free from the disease, thus demonstrating that the growths were primary lesions and not metastases. In 1904 Bunting[31] emphasized that the Billroth criteria applied only to malignant growths arising in different organs. Billroth's criteria for diagnosis of multiple primary malignant tumors were so highly restrictive that they ruled out many multiple primary cancers. They did not admit the possibility of multiple primary malignancies within a single organ such as colon or rectum.

TABLE III

MALIGNANCY OF THE LOWER BOWEL WITH PRIMARY MALIGNANT NEOPLASIA OF THE FEMALE GENITALS OR BREAST

Name	Age	Site	Genital Organ Involved	Additional Sites	Treatment
M. M.	69	Sigmoid	Breast		None
F. W. C.	50	Rectum	Cervix		R
P. G.	41	Sigmoid	Uterus	Bladder	R
A. L.	72	Rectum	Breast		None
E. L.	52	Rectum	Uterus		R
L. R.	49	Rectum	Ovary		R
L. S.	66	Sigmoid	Breast	Transverse Colon	R
J. L.	42	Rectosigmoid	Breast		C
B. D.	44	Rectum	Ovary		EL
N. B.	69	Rectum	Uterus		EL
R. W.	42	Rectum	Ovary		EL
W. C.	37	Rectum	Ovary		R
M. K.	43	Sigmoid	Ovary (bilateral)		R
J. J.	65	Rectum	Pancreas	Ovary	R

R = resection; EL = exploratory laparotomy; C = colostomy

More reasonable and functional criteria for the detection of these lesions were introduced by Warren and Gates[5] in 1932. They are as follows: (1) each tumor must present the picture of malignancy; (2) each tumor must be distinct; (3) the probability of one being a metastasis of the other must be excluded. It is only natural, therefore, that these new criteria brought an increase in the reported incidence of multiple primary malignancies.

Other factors also are responsible for the increased rate. The life expectancy of man has increased greatly in the last fifty years with the result that more people are living in the so-called "cancer age." An increasing number of people survive a radical surgical or radiologic procedure for cancer long enough to develop another malignant lesion. Education of the medical profession as well as the laity to symptoms of cancer is bringing more people to the doctor's office and clinic for examinations. Clinically, the more extensive utilization of available diagnostic facilities and maneuvers such as x-ray studies and tissue biopsies, routine sigmoidoscopy to as high a level as possible, the more careful exploration of the abdominal viscera at operation, the removal of a more extended segment of bowel during surgery, and the diligent following and complete re-examination of patients at periodic intervals for as long as possible are paramount in the detection of one or more cancers.

SUMMARY

1. Multiple primary malignant neoplasms are not a rarity and are probably more frequent than the reported statistics indicate.

2. One malignancy apparently does not confer an immunity against another malignancy in the same individual, at least not an immunity that can be determined clinically. In fact, a person who has had one malignant neo-

plasm is more likely to have another than a person who never has had a malignant tumor.

3. A series of 1,112 consecutive cases of cancer of the colon, rectum and anal canal in which there is an incidence of multiple primary malignancy of 7.5 per cent are presented.

4. Various contributing factors are enumerated which probably influence the progressively rising reported rate of multiple primary malignant neoplasms.

5. Two cases of adenocarcinoma of the sigmoid and rectum with coexisting sarcoma are added to the literature.

6. Because of the frequency with which carcinoma of the female genital organs is encountered concurrently with malignancy of the rectum and colon, the authors recommend castration of female patients forty or more years of age at the time of resection.

Addendum. Since acceptance of this article for publication four instances of multiple primary malignancy have been encountered in forty-eight additional cases of cancer of the large bowel as follows: pancreas one, ovary one, right colon one and sigmoid colon one.

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COMPLICATIONS OF ABDOMINAL COLOSTOMY*

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FOR many reasons more people are living today with colostomies than there have ever been in the past. In recent years there has been a campaign to avoid the procedure completely, particularly in cancer of the rectosigmoid colon and rectum. The weight of surgical opinion, however, is not in accord with this trend. It is true that colostomy may be troublesome, but when properly constructed and managed it is usually compatible with normal social pursuits. Much of the antipathy, both lay and professional, to this life-saving measure is due to misconceptions. Many of the frequent and varied complications of colostomy are avoidable or correctable by careful planning of the operation and sufficient attention to instruction of the patient.[11]

The problems complicating this procedure may manifest themselves immediately after operation or some time later. The early distant complications of colostomy are as follows: (1) complications or mortality due to pulmonary, renal and vascular incidents; (2) urinary infection; (3) psychologic (depression with first knowledge of colostomy). The early local complications of colostomy are as follows: (1) peritonitis; (2) obstruction of small intestine over proximal loop of colostomy and of proximal loop of colostomy; (3) prolapse of small intestine at site of colostomy; (4) gangrene of proximal loop and of distal loop; (5) wound infection; (6) ulceration of loop by rod under tension; (7) recession of loop; (8) irritation of skin; (9) crushing of spur with acute perforation of colon, injury to small intestine, ureter, hemorrhage and gangrene of loop.

The late distant complications of colostomy are psychologic and will be discussed later. The late local complications of colostomy are as follows: (1) intussusception or prolapse of proximal loop and of distal loop; (2) spillage from upper to lower loop; (3) recession of loop; (4) fistulas following closure; (5) stenosis; (6) incisional hernia; (7) inguinal hernia following ilial colostomy; (8) irritation of skin; (9) objectionable odor; (10) diarrhea; (11) sepsis of umbilicus; (12) hemorrhage from exposed mucosa; (13) involvement of loop by carcinoma or lymphopathia venereum; (14) perforation.

In order to ascertain the incidence of such complications a study was undertaken of the abdominal colostomies performed at the University of California Hospital since 1918. The Rankin obstructive resection and procedures of the Mikulicz type, in which exteriorization was a temporary measure, were not included because they present problems of their own which would alter our findings deceptively and are not pertinent to this study. Cecostomies were also excluded. Of a total of 569 colostomies the majority were performed for carcinoma. Yet the conditions requiring this procedure were varied, including twenty-seven different lesions.

The complications studied were those which could be attributed directly to the colostomy, namely, distant or local complications occurring in a case in which colostomy alone was done and those developing in the colostomy itself when another procedure in addition to colostomy was done. Thus many complications in which the colostomy itself could not be incriminated were omitted. The adverse social and psychogenic effects of colostomy are incompletely examined as well as minor but nonetheless distressing complications. In many instances the term "difficulties" would be more apropos.

In the 569 consecutive colostomies direct complications occurred in 168 cases or 29.5 per cent. In twenty-two cases more than one complication occurred so that the total number of complications was 248. One unfortunate patient had such recurrent difficulties that he is credited with eight.

The number of colostomies performed has increased by fourfold in the last three decades and the percentage of complications has risen by 15 per cent in the recent period. This is undoubtedly due to the fact that a comparably

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greater number of patients survives long enough for such complications to develop.

A high incidence in our youngest age group reflects the frequent complications which follow colostomy in infants suffering with anomalies of the gastrointestinal tract.

TABLE I
COMPLICATIONS OF COLOSTOMY

Types of Complications*	No.	Complications (Per cent)
Stenosis (stricture)	78	32
Prolapse	27	11
Hernia	27	11
Poor function (difficulty with control)	17	7
Wound infection (of colostomy wound)	15	6
Obstruction of the small bowel	10	4
Bleeding	10	4
Diarrhea	10	4
Fistula of colostomy	7	3
Necrosis of colostomy loop	7	3
Recession of colostomy loop	7	3
Peritonitis	5	2
Recurrent carcinoma in colostomy	5	2
Obstruction of colostomy	5	2
Loop perforation during irrigation	3	1
Urinary infection	2	0.8
Excoriation of skin	2	0.8
Evisceration	2	0.8
Fecal impaction	2	0.8
Subcutaneous emphysema	1	0.4
Pelvic abscess	1	0.4
"Loop too long"	1	0.4
Severe psychic reaction	1	0.4
Suicide	1	0.4
Involvement by lymphopathic venereum	1	0.4
Calcified fecalith, distal loop	1	0.4

* Multiple complications are counted individually

Stenosis, prolapse and hernia were the most common complications, but fortunately more serious ones such as small bowel obstruction, necrosis of the colostomy loop and perforation occurred infrequently. (Table 1.) Their occurrence is, however, of sufficient frequency to warrant serious attention. Space does not permit discussion of treatment. We are primarily concerned with the causes and means of prevention of these complications.

Stricture. Stricture occurred about the emerging loop of bowel in seventy-eight cases (13.7 per cent of the colostomies) and comprised 32 per cent of the complications. The narrowing was usually at skin level and was first noted several weeks or months postoperatively. In our series the occurrence of stricture was not related to the site or type of incision. However, it occurred with much greater frequency in single than in double-barrelled colostomies. This is somewhat at variance with the experience of others who believe that the stab wound alone is the responsible factor. No doubt the length of an ilial incision is greater when it is made to accommodate two loops. The surgeon's decision is divided between an incision that will be too tight and one that is too large and will allow prolapse or herniation. Whether the bowel loop is brought out through a separate incision or through the operative wound, precise planning of the skin opening is of importance. In neither instance is snug apposition of the skin to the bowel necessary. Excision of an ellipse of skin has been advocated.[13] Wound infection is a predisposing factor.[3] Although it is important to give the patient detailed instructions for self-dilatation after he has left the hospital, this maneuver is somewhat painful and will not invariably prevent the condition.

The ideal colostomy will admit the tip of one's finger and will pass a narrow stool. If it is smaller than this, symptoms of low grade partial obstruction will occur and irrigation is rendered difficult.

Hernia. Hernia was the second most common complication. It varied from a diffuse weakness about the colostomy to a more localized prominent bulge. It was four times as frequent in inguinal as in left rectus colostomies. There was no instance of hernia through the inguinal canal such as had been recorded following other simple ilial incisions.

Among the factors contributing to hernia are improper wound healing or closure and the use of a colostomy bag, especially one with a hard ring, rather than a supporting elastic belt.[1,14]

Prolapse. Prolapse usually involves protrusion of the mucosa, although a large section of bowel may protrude, amounting to intussusception of the full thickness of the bowel wall.[9] Like hernias, it is more common in inguinal colostomies, occurring here in twelve instances compared to six in about an equal number of rectus incisions. Although most common in the proximal loop it may occur in the distal loop as well. It is troublesome to the patient and results in increased moisture, bleeding from the mucosa, interference with care of the

colostomy and, when large may be serious. It has been presented as an argument against the procedure.

Several factors are involved in prolapse, namely, (1) too much sag or freedom in either loop[10] which may, in addition, make irrigation more difficult; (2) use of a cup or bag which not only weakens the structures it covers but also may exert a suction-like effect; (3) an excessively large defect in the abdominal wall from failure to close it snugly and loss of tissue from infection or sloughing, such as may result from placing sutures in the bowel wall or from erosion by a hard glass tube; (4) relaxation of the abdominal wall from atrophic or atonic tissue; (5) redundant bowel following resolution of inflammation in the gut or its mesentery resulting in an increase in length and mobility; (6) obstruction of the lower segment and (7) increased intra-abdominal pressure.[7]

Poor Function. Many patients are disturbed, particularly when the colostomy is new, because irrigation does not seem to them to be effectual. All of the irrigating fluid may not return. Occasionally this is due to actual obstruction by firm feces acting as a ball valve and may be relieved by digital disimpaction or a mild saline cathartic. A change of position during irrigation may relieve an angulation and gentle massage of the abdomen may be of value.[6] Often the patient's anxiety may be dispelled by simple reassurance.

Small Bowel Obstruction. Much has been said of the danger of herniation of a loop of intestine between the emerging colostomy loop and the anterior abdominal wall. In this series this was an infrequent complication occurring but six times in 569 colostomies. Both ilial and main wound colostomies have been thought to be factors in this complication.[13] The site of colostomy was not of importance in this series. Five of the six obstructions occurred in single loop colostomies. In three the mesentery had been sutured to the peritoneum, but a hiatus had developed through which the small bowel could enter.

Obstruction of the Colostomy. Too tight closure of the deeper layers of the abdominal wound is to be avoided. A satisfactory standard is that it should be possible at the time of closure to pass the index finger easily alongside the emerging loop. An intermediate suture between loops adds to the danger. Angulation and tension of the loop may be responsible.

Necrosis of Colostomy Loops. Gangrene may occur in either loop, may extend to any depth and has no relation to the type or site of incision. It occurred seven times in this series and may be a grave complication. The newly made colostomy should be inspected frequently during the immediate postoperative days for adequacy of circulation. Necrosis may result from tension, tight closure, improper division of the mesocolon or injury to nutrient vessels at operation, postoperative distention or sudden increase in intra-abdominal pressure due to straining and coughing.

Recession of the Loops. As a result of undue tension, inadequate mobilization, not leaving sufficient bowel protruding above the skin surface, necrosis or, in a loop colostomy, too early removal of the supporting tube beneath the loop, recession may occur. The entire limb of the colon may retract for variable distances beneath the skin or the intervening spur may recede to a point at which the fecal stream is no longer diverted from the distal segment.[5] Various methods of construction and of opening the loop tend to overcome the latter event.

Hemorrhage. Bleeding from trauma to the exposed mucosa is usually slight although it may be alarming to the patient. One must, of course, consider the possibility of an additional overlooked lesion in the bowel. Rough gauze in contact with the mucosa may produce bleeding. The application of a bland ointment and use of soft dressings will usually correct this difficulty. In any event it will subside with time as the mucosa becomes adapted to its environment.

Urinary Infection. Milwidsky and Mandl[8] found that after simple colostomy organisms, usually Escherichia coli, could be cultured from the urine in 82.5 per cent of the cases. Likewise there was a high incidence of mild clinical urinary infection. They refer to the term "enterorenal syndrome" in use in the French literature. Although in our series the incidence of recorded urinary infection is low, no such specific examination for bacteriuria was routinely undertaken.

Perforation. Perforation occurred in only three cases in this series. The patient must be supplied with proper apparatus for irrigation and time taken to instruct him carefully in its use. Perforation may occur even after long familiarity with the procedure.

Psychic Reaction. Only the most marked psychic reactions are included as complications. Experience indicates, however, that almost every patient shows some degree of emotional response to the operation. A fearsome and unpleasant picture has been painted in the literature to emphasize the undesirability of colostomy. Social ostracism, suicide, divorce,[4] economic hardship, esthetic repugnance and other consequences are stressed. These factors form the chief basis of arguments against abdominal colostomy, yet none would dispute the amputation of an extremity or enucleation of an eye when a comparable situation exists. It cannot be denied that many patients become depressed when after operation they are first faced with the reality of the transplantation of the bowel. However, if the situation has been approached wisely, such depression will be transient. The great majority of patients are proud of their ability to carry on a normal life with their handicap.

Opinion is divided as to whether or not the patient should be told before operation that he is to have a colostomy.[2] The solution of this problem taxes all of the resources of the surgeon's experience, psychiatric knowledge and medical art. To allow a patient to refuse operation and then to have him reappear with a serious complication or inoperable lesion is a turn of events to be hoped against. Many considerations make it advisable to apprise the patient of the necessity of the procedure beforehand and to assure him that he will be able to pursue a useful life. On occasion, however, when the patient is adamant in his refusal, an alternative operation which avoids abdominal colostomy will have to be performed.

SUMMARY

Addominal colostomy is often an essential and life-saving measure in a variety of lesions of or related to the large bowel. The frequently used expression "simple colostomy" is misleading since complications may be numerous and are occasionally serious; many are avoidable. The procedure should, therefore, be planned and executed with care. Time spent in instruction of the patient is well repaid by his comfort and rehabilitation.

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TREATMENT OF MASSIVE RECTAL PROLAPSE*

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MASSIVE prolapse of the rectum constitutes a grave disability and its surgical repair presents many technical problems. It is generally accepted that prolapse of the rectum is a sliding hernia of the anterior wall through a defect in the endopelvic fascia. This defect is created by stretching and atrophy of the transversalis fascia and suspensory ligaments of the rectum. Loss of the anterior support results in straightening of the normal posterior curve of the rectal canal so that the bowel runs in a vertical direction. Any increase in intra-abdominal pressure thus acts directly in the long axis of the bowel and aggravates the tendency to prolapse. (Fig. 1.)

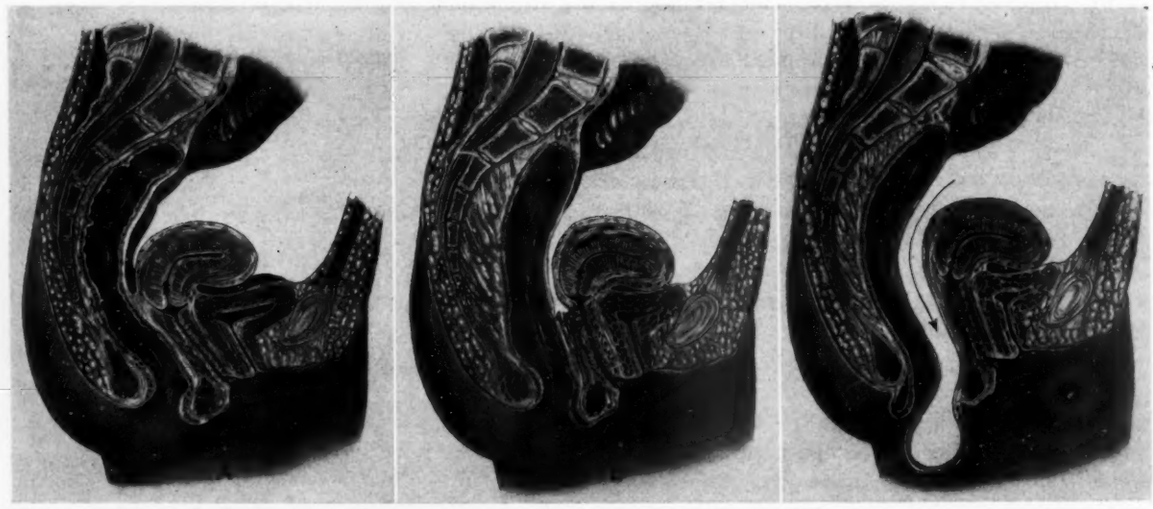

FIG. 1. A, Normal relationships of the rectum; B, the rectum loses its posterior curve and prolongation of the peritoneal pouch is beginning anteriorly; C, well developed prolapse—a sliding hernia of the anterior wall.

Many surgeons have suggested methods of repair based on these tenets. Graham[2] advocated an abdominal approach with removal of the excess peritoneum and suture of the levator muscles in the midline to form an anterior support for the rectum. Mayo[3] used strips of fascia lata as the foundation for a new pelvic floor constructed of peritoneum. Orr[4] recommended the use of fascial bands to anchor the rectum into the hollow of the sacrum. Various other types of fixation have been advocated but the multiplicity of operations suggests that none is wholly satisfactory.[1]

It seems obvious that an adequate procedure must meet the basic requirements of any hernia repair, i.e., removal of the sac and repair of the defect through which it comes. In addition, the posterior curve of the rectum must be restored in order to minimize the effect of increased intra-abdominal pressure.

Prolapse of the rectum usually occurs in elderly multiparous females in whom the pelvic supports of the rectum are atrophic. In our experience the Graham operation has been unsatisfactory because the levator muscles are so thin and friable that they do not form an adequate anterior support. In order to strengthen the pelvic floor we have employed a graft of fascia lata in such a way that it provides an anterior sling and holds the rectum back into the hollow of the sacrum. This procedure has

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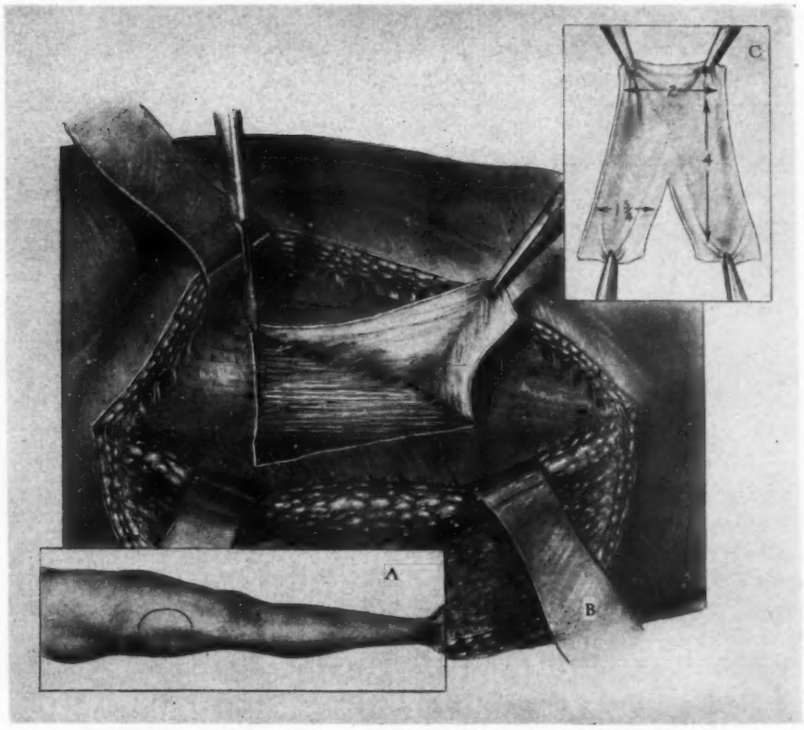


FIG. 2. A, Incision; B, removal of fascia; C, fashioning of graft.

FIG. 3. The peritoneum is mobilized and the graft sutured in place.

FIG. 4. The peritoneum is closed over the fascial graft.

been used in four patients, with uniformly good results.

OPERATIVE TECHNIC

Spinal anesthesia is used. The patient is placed in Trendelenburg position and the abdomen is entered through a left rectus muscle-splitting incision. The peritoneal reflections are divided on either side of the rectosigmoid and the flaps mobilized as in an abdominoperineal resection. Both ureters are isolated and traced downward into the bladder. The peritoneum is incised anteriorly along the base of the bladder and the excess peritoneum in the

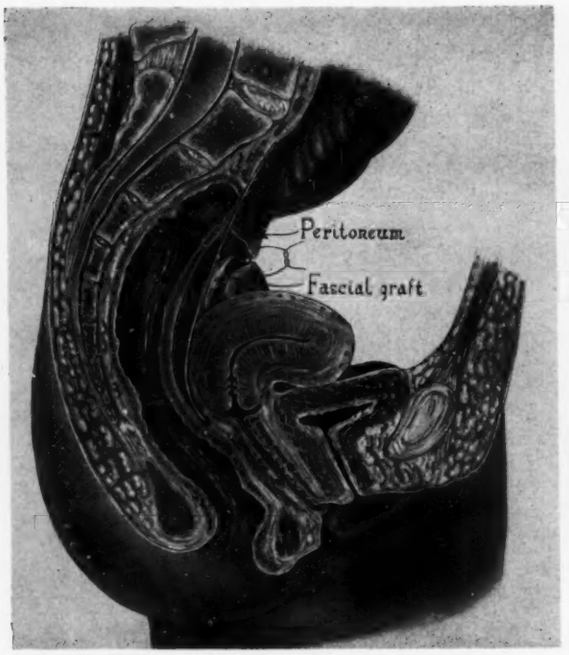


FIG. 5. Relationship of graft to pelvic structures.

pouch of Douglas is freed and excised. This constitutes the hernial sac. At this stage the anterior defect in the pelvic fascia can be readily demonstrated and downward pressure on the rectosigmoid will reproduce the prolapse. The bowel is pulled upward and the levator muscles are approximated in the midline with interrupted sutures extending from the base of the bladder to the rectum. In all of our cases this has been a thin layer which gives little support.

A fascial graft is then removed from the right thigh. The fascia lata is exposed by a curved incision and a rectangular graft measuring 2 by 4 inches is removed. This is shaped as illustrated in Figure 2. The apex of the graft is then sutured anteriorly to the fascia at the base of the bladder and the lateral edges are sutured to the levators close to their origins. The limbs of the V are brought around either side of the rectum and fixed to the fascia overlying the promontory of the sacrum and the pelvic brim. The edges of the defect in the graft are sutured to the bowel wall. The rectum is thus encircled by a new pelvic floor which gives it adequate anterior support and holds it back into the hollow of the sacrum. (Fig. 3.)

The pelvic peritoneum is sewn over the fascia obliterating the pouch of Douglas. The sigmoid colon is fixed to the retroperitoneal tissues on the left as advocated by Pemberton

FIG. 6. Postoperative lateral x-ray of the pelvis in a case of rectal prolapse treated by the fascial graft method. Note that the posterior curve of the rectum into the hollow of the sacrum has been restored.

and Stalker[5] and the abdomen is closed without drainage. (Figs. 4 and 5.)

Postoperatively the patient is kept supine for four to five days with the foot of the bed elevated. Sphincter exercises are started preoperatively and continued throughout the hospital stay.

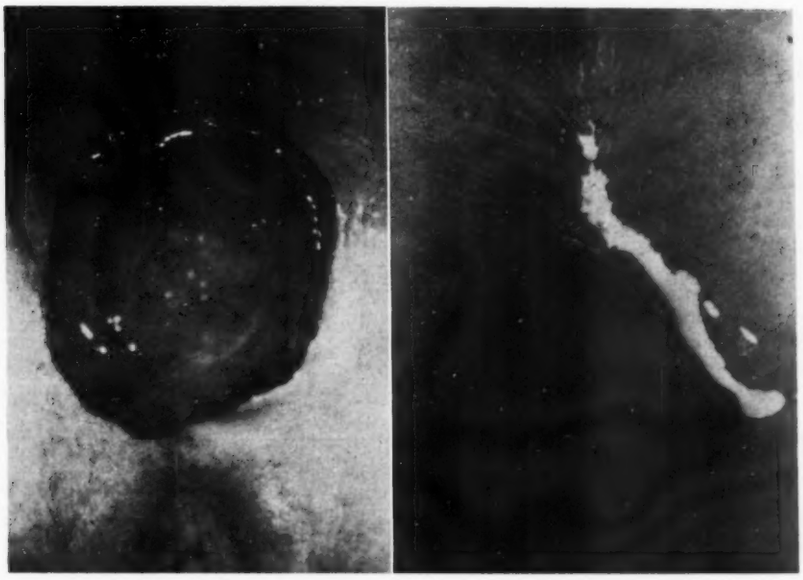
COMMENT

This procedure has been carried out in four patients, all of whom were elderly females; the average age was sixty-five. In all cases the prolapse occurred spontaneously on standing and became aggravated when the patient strained.

These cases have been followed up for periods of eighteen, sixteen, twelve and eight months. There have been no recurrences to date and in all instances symptoms have been completely relieved.

The patulous sphincter ani begins to regain its tone about one month after operation and in all cases full continence has been restored within two to three months.

This operation appears to satisfy the basic requirements for an adequate repair of the prolapsed rectum. It provides a firm anterior fascial support in patients with atrophic pelvic structures and restores the normal anatomic position of the rectum. Results to date have been thoroughly satisfactory. (Figs. 6 and 7.)



7A 7B

FIG. 7. A, Preoperative photograph of a case of rectal prolapse. Note that the lumen is posterior and almost the entire prolapse is carried in the anterior wall. B, postoperative photograph with the patient straining. A trickle of barium is emerging from the rectum but there is no evidence of prolapse.

SUMMARY

1. Massive rectal prolapse is a sliding hernia of the anterior rectal wall through a defect in the fascial supports of the rectum.

2. In most cases the pelvic fascia and the levator muscles are thin and atrophic.

3. A satisfactory repair must provide adequate anterior support and restore the normal posterior curve of the rectum.

4. The operation described involves the formation of a new pelvic floor from a graft of fascia lata.

5. Results in four cases have been satisfactory, with complete relief of symptoms and no recurrences.

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Obstetric Clinic

THE woman about to become a mother or with a new-born infant upon her bosom, should be the object of trembling care and sympathy wherever she bears her tender burden, or stretches her aching limbs. The very outcast of the streets has pity upon her sister in degradation, when the seal of promised maternity is impressed upon her. The remorseless vengeance of the law brought down upon its victims by a machinery as sure as destiny, is arrested in its fall at a word which reveals her transient claim for mercy. The solemn prayer of the liturgy singles out her sorrows from the multiplied trials of life, to plead for her in her hour of peril. God forbid that any member of the profession to which she trusts her life, doubly precious at that eventful period, should hazard it negligently, unadvisedly or selfishly.

OLIVER WENDELL HOLMES

8th of the Series

HEART DISEASE AND PREGNANCY*

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HEART disease is rapidly becoming the most important complication of pregnancy. This is not due to an increased frequency of heart disease nor to an increased mortality rate among cardiac patients, but to the reduction of maternal mortality from hemorrhage, toxemia and infection. Whether there has been any reduction in the mortality rate of heart disease associated with pregnancy is doubtful. Maternal mortality figures never did accurately reflect the important role played by heart disease as a cause of death during pregnancy.

* * * *

CASE 1. A twenty-six year old woman, gravida III, para II, was first seen by her physician during the eighth week of her third pregnancy. Her first pregnancy had terminated in the delivery of a stillborn fetus at seven and a half months. Labor was complicated by moderate vaginal bleeding due to partial separation of the placenta. She stated that she had had rheumatic fever at the age of nine. However, there were no cardiac complications during her first pregnancy.

The prenatal course of the patient's second pregnancy was uneventful until the eighth month when dyspnea on exertion and tachycardia developed. With treatment at home by rest and digitalis she improved. Uneventful delivery occurred at term.

When first seen during her third pregnancy she was referred to an internist who made a diagnosis of mitral stenosis, Class II, and advised the patient to rest frequently and to report immediately any symptoms of cardiac strain. She was seen at two-week intervals by her obstetrician and monthly by the internist. Progress was satisfactory until the sixth month when dyspnea on exertion developed. This was mild and not considered important by the patient. When dyspnea suddenly became severe, she was admitted to the hospital in cardiac decompensation. Treatment included the use of morphine, intravenous digitalis and aminophyllin and phlebotomy of 650 cc.

* Cases are from the Committee on Maternal Welfare of the Medical Society of the County of Kings, Brooklyn, N. Y. The views expressed are those of the authors.

She expired in twenty-four hours undelivered. Autopsy revealed mitral stenosis and insufficiency, pulmonary edema and congested viscera.

CASE II. This thirty-six year old woman, gravida III, para II, reported to her physician during the third month of her third pregnancy with the following history. Her first pregnancy had terminated in a normal delivery six years previously. During the antepartum course of that pregnancy she learned for the first time that she had a "heart condition." There were no cardiac symptoms and no special treatment.

Her second pregnancy four years later also resulted in a spontaneous delivery, but during the antepartum period she complained of exertional dyspnea and tachycardia. This was considered not unusual and probably due to the pregnancy. Forty-eight hours after delivery orthopnea, dyspnea, tachycardia and precordial pain developed. A diagnosis of mild cardiac decompensation was made and treatment included digitalization and bed rest. The patient's recovery was excellent and she was discharged on the tenth postpartum day. During the interval between her second and third pregnancies she had no complaints other than moderate exertional dyspnea.

At the time of the first prenatal visit of her third pregnancy a diagnosis of rheumatic heart disease was made and consultation with an internist advised. The diagnosis was confirmed and the patient instructed to restrict her activities and take rest periods. Antepartum visits at three-week intervals were advised. Her course was uneventful until the fifth month when nocturnal orthopnea developed. When a cough developed during the sixth month the patient was digitalized and instructed to rest more. Dyspnea and orthopnea became severe in the seventh month and were accompanied with hemoptysis. On admission to the hospital pulmonary edema was present. This did not respond to morphine, oxygen, aminophyllin or digitalis and the patient expired undelivered.

Questions. (1) How often is heart disease associated with pregnancy? (2) Is the diagnosis difficult? (3) Is the history important? (4) Is there a reliable test for cardiac reserve? (5) Is there a classification of pregnant cardiac patients which may help in their management?

Answers. The incidence of heart disease in pregnancy is influenced by living conditions, climate and many other factors but is generally believed to be between 1 and 2.5 per cent. The importance of this complication is obvious when we remember that it exceeds in frequency placenta previa, ablatio, rupture of the uterus, eclampsia and postpartum hemorrhage. The management of these complications is for the most part fairly well agreed upon, but this cannot be said for the management of heart disease associated with pregnancy. Too often the gravity of heart disease is not recognized nor the indication for hospitalization appreciated prior to cardiac failure. Once that has occurred, mortality rates rise despite the best of treatment.

The diagnosis of heart disease during pregnancy usually is not difficult unless the patient is seen for the first time during the last trimester. Rheumatic heart disease is by far the more common type, being responsible for 90 to 95 per cent of all cases. A history of rheumatic fever is of great importance and will be obtained in the majority of cases. In the remainder the typical murmurs of stenosis and insufficiency will be heard. A diagnosis of heart disease during the latter months of pregnancy may be exceedingly difficult in the absence of definite history or a previous examination. Pregnancy itself may so alter circulatory dynamics as to produce findings which closely simulate organic heart disease. Variations in heart sounds and rhythm as well as symptoms of palpitation and dyspnea may occur. These are the result of the cardiac strain secondary to increased blood volume and cardiac output as well as rotational changes in the heart from uterine pressure. *If the physician is unable to differentiate a functional disturbance from an organic one, he will do well to treat it as the latter.*

The most important factor in prognosis is *the functional capacity of the heart.* This has little to do with etiology, types of murmurs or the number of valves involved. The physician must estimate what the patient is capable of doing. How does she carry on her household duties? Or, can she walk upstairs without developing cardiac symptoms? In that way he evaluates the patient's cardiac reserve. A further check on this cardiac reserve may bemade by exercise tests. The management of individual cases will vary considerably, depending upon classification. For this reason the following functional capacity classification of the New York Heart Association is recommended:

Class I, patients with cardiac disease and no limitation of physical activity: Ordinary physical activity does not cause discomfort.

Class II, patients with cardiac disease and slight limitation of physical activity: They are comfortable at rest. If ordinary physical activity is undertaken, discomfort results in the form of unusual fatigue, palpitation, dyspnea or anginal pain.

Class III, patients with cardiac disease and marked limitation of physical activity: They are comfortable at rest. Discomfort in the form of unusual fatigue, palpitation, dyspnea or anginal pain is caused by less than ordinary activity.

Class IV, patients with cardiac disease who are unable to carry on any physical activity without discomfort: Symptoms of cardiac insufficiency are present even at rest.

The assignment of patients to one of these classifications assumes greater importance when we realize that the functional capacity of the heart to do work is without doubt our most reliable guide to prognosis and management. Increase in the patient's weight calls for greater cardiac work, as does the increase in blood volume, blood viscosity and basal metabolism. Cardiac output begins to increase about the twelfth week and gradually rises until the thirty-sixth week when it is from 25 to 50 per cent more than in the non-pregnant state. During the last month cardiac output decreases slowly until term. There is no implication that any classification is permanent; it may change as the pregnancy progresses, usually for the worse. Other factors of importance in prognosis are the patient's age, size of the heart and a history of previous decompensation or auricular fibrillation.

Patients in Class III and Class IV are those most likely to develop decompensation, whereas those in Class I and Class II usually do well. One should never lose sight of the fact, however, that as the pregnancy progresses some patients in Classes I and II will have to be shifted to Class III.

It is obvious that good management of these patients demands the closest cooperation of cardiologist and obstetrician. Consultation with a cardiologist or internist is not sufficient. If functional capacity is to be properly evaluated, the internist must examine the patient at stated intervals throughout her pregnancy. Only meticulous prenatal care with frequent examinations by obstetrician and internist will result in early recognition of impairment of cardiac reserve. This in turn will lead to earlier hospitalization, prevention of cardiac decompensation and fewer deaths.

* * *

CASE III. This patient was a forty-two year old woman, gravida VI, para V, with a history of rheumatic heart disease beginning at the age of eighteen. Her pregnancies and deliveries were uneventful except the fifth one which had occurred three years previously. The antepartum course of that pregnancy was complicated by some dyspnea and increased heart rate which responded to rest.

During the fourth month of her sixth pregnancy she was admitted to the hospital in cardiac failure. She responded to medical treatment and was kept under observation in the hospital for two months. She was then permitted to go home after being given careful instructions as to restriction of activity, rest and diet. She was readmitted to the hospital one week later, however, in acute cardiac decompensation and expired undelivered twelve hours later.

CASE IV. This patient was a twenty-five year old woman, gravida II, para I, with a history of cardiac decompensation during the fifth month of her previous pregnancy. There had been no history of rheumatic fever or chorea although the physical cardiac signs were those of mitral disease. She had been treated at that time with sedation, digitalis and bed rest. Improvement was marked and she was delivered at term without difficulty.

Her present pregnancy was uneventful until the fourth month when dyspnea developed and rapidly became worse. On admission to the hospital she had marked cardiac decompensation with pulmonary edema. All treatment was ineffectual and she expired within six hours.

CASE V. A twenty-four year old woman, gravida II, para I, had had a known cardiac condition for several years. She gave no history of rheumatic fever although the typical findings of mitral stenosis and insufficiency were present. The labor and immediate postpartum period of her first pregnancy were said to have been uneventful. However, one month after delivery she was treated for cardiac decompensation. Subsequent examinations revealed her

cardiac status to be good and there was no further history of any cardiac embarrassment.

She was referred to an obstetrician by her physician during the third month of her second pregnancy because of her history. He in turn referred her to a cardiologist who reported that she had rheumatic heart disease with mitral stenosis and insufficiency, Class III. She was placed on restriction of physical activity, low sodium diet and was completely digitalized and maintained on this routine. She visited the cardiologist and the obstetrician alternately every two weeks. Despite a seemingly uneventful prenatal course she went into acute heart failure at twenty-eight weeks and was hospitalized. Treatment included continuous oxygen, morphine, intravenous aminophyllin and phlebotomy, but she expired ten hours after admission.

Questions. (1) How should patients be managed when there is a history of cardiac decompensation during the antepartum period and prior to the present pregnancy? (2) When is cardiac decompensation most likely to occur during pregnancy?

Answers. The biggest problem in obstetric cardiology is the prevention of congestive heart failure. Most heart failure is seen when the load of pregnancy is the heaviest or when additional demands of work or infection are made upon an already diminishing cardiac reserve. Cardiac reserve is but the difference between the work the heart is doing and the work it is capable of doing.

These cases illustrate the tendency of cardiac decompensation to occur between the fourth and the eighth months. If cardiac failure has occurred in the early months of pregnancy, we can be sure that it will recur in the latter months when the strain is greater unless adequate steps are taken to prevent it. Similarly, if congestive heart failure occurred in a previous pregnancy, we know that cardiac reserve is small and again can predict at least a 75 per cent risk of decompensation in a subsequent pregnancy.

Obviously, the one way of preventing decompensation would be to avoid pregnancy. This is not a good answer as a baby is the heart's desire of most women and to deprive them of that privilege is unwarranted. More important than that, however, is the fact that large series of cases have now been compiled proving that congestive heart failure with its accompanying high mortality can be markedly reduced by the single factor of good prenatal care.

By now it should be clear that adequate prenatal care for the pregnant woman with heart disease is a far cry from what is considered good care for the average pregnant patient. The minimum standard of prenatal care for pregnancy associated with heart disease is as follows: (1) Weight gain is not to exceed 20 pounds. (2) Sodium intake should be restricted throughout pregnancy. (3) Definite daily rest periods should be outlined. (4) Housework and all other physical activity should be restricted. (5) There should be prevention of anemia. (6) The occurrence of a simple cold or other infection demands complete rest. (7) Class I and II patients must be seen at intervals of two weeks even in the early months of pregnancy. Attention should be directed to an evaluation of cardiac reserve as evidenced by undue fatigue, lassitude, increasing dyspnea on exertion, elevation of pulse rate, unexplained excessive weight gain or edema, or cough. If any one of these symptoms or findings is noted, hospitalization or weekly examinations are then indicated, depending upon impairment of cardiac reserve. It should again be emphasized that as the load of pregnancy increases, patients in Classes I and II may shift into the less favorable classes. (8) *All Class III and IV patients are to be placed at bed rest from the twelfth week of their pregnancy until delivery. This is best accomplished by hospitalization. Home care is not safe.* (9) Any patient who gives a history of previous decompensation is to be considered Class III or IV regardless of functional capacity at the time first seen.

It becomes quite apparent that, economically, pregnancy with heart disease may give rise to difficulties. The financial burden of the patient spending months of her prenatal period in a hospital, added to the costs of delivery and aftercare, may be more than the family pocketbook can bear. However, it is only in that way that the mortality rate can be reduced. City and county hospitals should be prepared to help carry the burden. *The public as well as the medical profession must be convinced of the necessity of early and prolonged hospitalization for these patients.* Within the memory of many of us, similar objections were raised in the treatment of pulmonary tuberculosis. Today

prolonged hospitalization with its resultant high rate of cure is accepted as a matter of course by the tubercular patient. Cardiac patients deserve no less.

* * *

CASE VI. A twenty-four year old primigravida with a history of rheumatic heart disease was admitted to the hospital during the seventh month of pregnancy in acute cardiac failure. Treatment consisted of intravenous digitalization, oxygen and bed rest. Improvement was rapid and she was discharged from the hospital in ten days with instructions concerning bed rest at home. Three weeks later she had a milder attack of decompensation and was again hospitalized for a few days and again discharged.

One week before her expected date of delivery she was admitted to the hospital for an elective cesarean section. A low classical section was performed under local anesthesia with no unusual cardiac distress noted on the table. On the second postoperative day a temperature of 103°F. and a pulse of 120 developed. Evidence of pulmonary edema soon appeared together with dyspnea and orthopnea and the patient expired twelve hours later. Autopsy revealed pulmonary edema, mitral stenosis and insufficiency and aortic insufficiency.

CASE VII. This twenty year old primigravida was admitted to the obstetric ward six days before her estimated date of confinement because of severe rheumatic valvular disease complicating pregnancy. She had attended the prenatal clinic faithfully where she was considered as having a Class II cardiac condition with mitral stenosis and insufficiency and aortic stenosis. The history of valvular heart disease dated back to the age of fourteen.

On admission to the hospital the fundus was at term with the vertex engaged. Because of the severity of the cardiac disease an elective cesarean section was thought advisable by the attending obstetrician and a cardiologist. Accordingly, a classical type of operation was performed under caudal anesthesia. The first twelve hours after operation were uneventful. Digitalis was not considered necessary as there was no evidence of cardiac decompensation. Eighteen hours postoperatively her pulse rose to 130 and her temperature to 102°F. Pulmonary edema developed and she expired six hours later. Autopsy showed acute cardiac failure, rheumatic pancarditis and pulmonary edema.

CASE VIII. A thirty-four year old primigravida was under the care of an obstetrician and a cardiologist throughout her pregnancy. A diagnosis of Class II mitral stenosis and insufficiency was made. Because of increasing dyspnea, leg edema and some tachycardia she was hospitalized at the beginning of the ninth month. After one week's observation it was decided to terminate the pregnancy by cesarean section. The classical operation was performed under ether anesthsia. The operation was uneventful until after delivery of the baby. Following the administration of 1 cc. of ergotrate intravenously and the delivery of the placenta the patient stopped breathing and no pulse was perceptible. Attempts at resuscitation and cardiac massage were unsuccessful.

Questions. (1) Is heart disease complicating pregnancy an indication for cesarean section? (2) Is prophylactic digitalization indicated in the antepartum period? (3) Should the use of oxytocics be avoided?

Answers. Rheumatic heart disease, regardless of its severity, is never an indication for cesarean section. For many years abdominal delivery was considered the procedure of choice in an attempt to eliminate the unpredictable strain of labor upon an already severely taxed heart. The logic of that method of delivery seemed sound as no apparent extra work is done by the heart during laparotomy. Yet it is well known that severe cardiac patients are poor surgical risks and the parturient proves to be no exception to this rule. Cardiovascular collapse is not infrequent. Ileus, sepsis, thrombosis, embolism and respiratory complications are more likely to occur following cesarean section. Anesthesia risks are also increased.

More important than the theoretic objections are the clinical results. It has been definitely established that cesarean section leads to a higher mortality rate than vaginal delivery, yet objection has been made that the serious cases were more likely to be delivered by cesarean section with the result that the statistics are misleading. Such an objection is not valid, however, as large, equally comparable series of Class III and Class IV pregnant cardiac patients have been delivered vaginally and by laparotomy. These studies leave no

doubts in the minds of obstetricians and cardiologists alike as to the increased dangers associated with cesarean section. All of the factors responsible for acute congestive failure in these patients following major surgical procedures are not as yet understood; perhaps some may be endocrine in origin with the adrenal gland playing a major role.

Heart failure rarely complicates labor if pregnancy has been borne well. This observation should weigh heavily in decisions as to the method of delivery for these patients. It is perhaps illustrated best by Case VII. Elective cesarean section was chosen for delivery in a compensated cardiac patient. The postoperative complications of fever and tachycardia precipitated acute congestive failure. Decompensation is not uncommon in the immediate postpartum period. Increased blood loss associated with cesarean section may aggravate preexisting anoxia with further vascular stasis and acute decompensation.

Once again the aforementioned cases emphasize the importance of continued hospitalization for the patient whose heart has decompensated. Initial improvement following hospitalization is frequently marked and may lead to undue optimism. Permitting the patient to go home knowing that cardiac strain increases as the pregnancy progresses will almost always result in her return with a second and usually more severe type of failure.

Cesarean section should be reserved for those cases which have an obstetric indication for the operation. Among those indications it would seem wise to include also patients whose physical findings indicate a long, hard labor, as in Case IX which will follow.

The use of digitalis should be reserved for cases which have evidence of decompensation. So-called prophylactic digitalization is not indicated and has certain drawbacks. If decompensation occurs following attempts at prophylactic digitalization, further use of the drug, even though it may urgently be needed, becomes difficult and even dangerous. Also, regulation of dosage is more difficult in the absence of failure. Some of the seemingly good results which follow the prophylactic use of this drug are the result of its use in cases of mild unrecognized failure. Congestive failure in its acute stage, as evidenced by dyspnea, orthopnea, tachycardia and pulmonary edema, is easily recognized. When present in its mild form, however, its recognition is more difficult yet even more important if disaster is to be averted. The patient in whom slight dyspnea and transient tachycardia develop while she is doing her housework may be showing the first sign of early decompensation and may be helped by digitalis. True enough, these signs may occasionally occur in the pregnant woman without heart disease. If digitalization should result in clinical improvement, it may be assumed that early failure was present.

All Class III and IV cardiac patients should be digitalized throughout the pregnancy. Some Class II patients may benefit by digitalization.

Pituitrin has a vasoconstrictor and hypertensive effect and should be avoided in the management of the third stage of labor. Ergot preparations, especially if given intravenously as in Case VIII, have a similar effect and are contraindicated. If general anesthesia is avoided, oxytocics will rarely be needed; when indicated they should be used intramuscularly.

* * *

CASE IX. A twenty-seven year old woman, gravida I, was admitted to the hospital at term with ruptured membranes, bloody show and cramp-like abdominal pains. She was a rheumatic cardiac patient and classified as Class I in early pregnancy by an internist.

On admission there were no signs of decompensation. Contractions were slow and ineffective, so after fourteen hours of labor morphine sulfate, ¼ gr., and scopolamine, 1/150 gr., were given. The vertex was high and the cervix dilated two fingers. Progress was slow and sedation had to be repeated several times.

After forty-six hours of labor, desultory in type, the cervix was dilated three fingers and the vertex just above the spines in R. O. P. position. It was then noted that the patient's pulse rate had risen to 120 and her respiratory rate to 24. Four hours later she went into severe cardiac decompensation and died undelivered.

CASE X. This patient was a twenty year old primigravida who had a known cardiac condition with a double mitral lesion. Decompensation developed during the fifth month and she was treated at home by bed rest and digitalis with good result. She again decompensated two months later when allowed out of bed but once more responded to the same treatment. She had no further trouble until she ruptured her membranes at term. Again there

was evidence of mild decompensation which her physician believed had been induced by excitement. Upon admission to the hospital she was found to be in mild labor with the cervix dilated one finger and effaced. The vertex was engaged in the R. O. P. position. Cyanosis, dyspnea and tachycardia had now developed. In view of the decompensation it was believed that she would not survive labor, so classical cesarean section was performed under local anesthesia. Pulmonary edema persisted after operation with the development of bronchopneumonia. She died on the second postoperative day.

CASE XI. A thirty-five year old female, gravida VI, para IV, was first seen by her physician during the fifth month of pregnancy. She was a known rheumatic cardiac patient for years. Her previous pregnancies and labors had been uneventful. The sixth pregnancy progressed normally until seven and one-half months when some dyspnea and tachycardia developed. Digitalis, 1½ gr. twice daily, was prescribed with seemingly good results. The patient was then carried to term without any apparent further sign of decompensation.

Labor progressed rapidly with strong contractions every three to four minutes. Morphine sulfate, ⅙ gr., was given for sedation. The patient was taken to the delivery room where she was delivered by low mid-forceps as soon as the cervix became fully dilated. Open drop ether was used for anesthesia. The delivery was not difficult and a slight laceration was rapidly repaired. Shortly after delivery she went into acute cardiac decompensation and died two hours later.

Questions. (1) What are the early signs of decompensation during labor? (2) What is the treatment of decompensation during labor? (3) Should all pregnant cardiac patients be delivered as soon as the cervix is fully dilated? (4) What is the anesthetic of choice for delivery of these patients?

Answers. Cardiac decompensation during labor is one of the worst possible situations which can confront the obstetrician. It is the result of either inadequate observation, lack of cooperation or an acute infection. Of these three there can be little doubt that *inadequate observation is the controllable factor responsible for the great majority of deaths.* Once again in Cases X and XI cardiac decompensation occurred in the antepartum period, yet the patient was allowed to remain at home. In Case IX there seems little doubt that an obstetric indication was present for cesarean section; even so, signs of impending failure were present for hours without being heeded. A pulse rate of 110 or over which persists during the first stage of labor should be considered a warning of impending failure. If associated with an elevation of the respiratory rate to 24 or over, the danger is even more acute.

These signs are of such importance as to warrant a count of the pulse and respiratory rates at fifteen to twenty minute intervals throughout the labor of every cardiac patient. If failure is impending as indicated by the aforementioned signs, or even worse, if decompensation has developed, the patient should be given morphine. The bed should be placed in low Fowler position and oxygen administered, preferably by a tent. Rapid digitalization by the intravenous route is indicated. If the patient has already been receiving this drug, it is best to assume that the drug level is inadequate and smaller divided doses should be given. Intravenous aminophyllin and phlebotomy may be indicated. Every effort must be made to carry the patient through the remainder of the first stage of labor with as little physical effort as possible. The expulsive efforts of the second stage of labor are harmful. However, much as it may be desired, routine delivery as soon as the cervix is fully dilated is open to question. The second stage of labor should be shortened *only as much as is consistent with good obstetrics.* The last case illustrates this point. A multipara having her fifth baby was subjected to mid-forceps under ether anesthesia as soon as the cervix became fully dilated.

The choice of anesthesia requires careful deliberation. Some form of conduction anesthesia is often ideal if expert anesthetists are available. Epidural and caudal anesthesia have distinct advantages, especially when small doses of the anesthetic agent are used. Respiratory embarrassment should not occur, nor is there any significant drop in the blood pressure. These anesthetics are particularly suited to the cardiac patient since they obliterate the bearing down reflex and give adequate anesthesia for forceps delivery.

If trained anesthetists are not available for conduction anesthesia, local anesthesia is the anesthesia of choice, and without question, the

safest. The technic of administration can be easily learned. Pudendal nerve block is usually necessary for forceps delivery, otherwise simple infiltration of the perineum with 0.5 per cent novocain is sufficient for repair of an episiotomy.

If inhalation anesthesia is necessary, ether is the drug of choice. It is the most frequently used general anesthetic and in average hands is probably the safest for the cardiac patient. High concentration of oxygen should be maintained and this may be best obtained by having a continuous flow of oxygen through a soft rubber tubing beneath the ether mask. Nausea and vomiting, so common with its use, plus the occasional excitement stage are its disadvantages.

Cyclopropane has many adherents due to the high oxygen concentration which may be maintained with its use. Cardiac arrhythmias may occur and are a contraindication to its use. Its margin of safety is small.

In cesarean section inhalation anesthesia is not ideal. Uterine atony, hemorrhage and shock occur more often with its use than with local or conduction anesthesia. Once self-restraint has been abolished in the second stage of anesthesia, fear and anxiety for herself and baby may cause the patient to vomit and thrash about, slowing induction and adding to the hazards of aspiration and hypoxia. However, if general anesthesia is used, ether supplemented with high concentration of oxygen should be selected.

Local anesthesia is the anesthesia of choice for cesarean section on the cardiac patient although it should not be selected for the fearful, highly nervous patient. Intravenous sodium pentothal may be used advantageously to supplement its use and can be used safely within five minutes of delivery of the fetus. No one questions the safety of local anesthesia for the cardiac patient. The only real argument against its use is whether or not one can obtain adequate anesthesia. The fault is generally not with the anesthetic or procedure but with the operator. Its technic demands proper administration of the drug, patience in awaiting its full effect before operating and the utmost gentleness in the handling of tissue. There need be no haste in the usual case.

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Case xii. This patient was a forty-two year old woman, gravida vi, para v. Her previous pregnancies were uneventful except that during her fifth pregnancy some dyspnea had developed as well as increased heart rate during the seventh month.

During the fourth month of her sixth pregnancy she was admitted to the hospital with cardiac decompensation. She responded to medical treatment and was kept under observation in the hospital for two months. She was allowed to go home during the sixth month after being given careful instructions about the necessity of bed rest. Two weeks later she contracted an upper respiratory infection and acute cardiac decompensation followed. She was readmitted to the hospital in critical condition and died shortly thereafter.

Case xiii. A twenty-six year old woman, gravida ii, para 0, was first seen by her obstetrician when three months pregnant. Her first pregnancy had terminated in a two months' spontaneous abortion. The patient, who had a known cardiac condition, was referred to a cardiologist who diagnosed mitral stenosis and insufficiency and aortic insufficiency. He classified the patient as Class iii. Since the patient had never had congestive heart failure, it was believed that under strict supervision and with detailed instructions she should carry on with the pregnancy. She did well until the twenty-third week when an upper respiratory infection with a severe cough developed. Two days later she had to be hospitalized because of cardiac decompensation. She was rapidly digitalized, given penicillin and placed in an oxygen tent; 600 cc. of blood were withdrawn. Despite these measures she died forty-eight hours later.

Questions. (1) How serious are upper respiratory infections in pregnant cardiac patients? How should they be treated? (2) Do multiple pregnancies shorten the life expectancy of cardiac patients? (3) Is the patient's age important?

Answers. The importance of upper respiratory infections as a causative factor in the production of cardiac decompensation cannot be overemphasized. Our files of cardiac cases contain many reports illustrating the devastating effects of the common cold and its complications. These infections interfere with respiratory function and put a great strain on the cardiac reserve. Although the common cold is not strictly an avoidable strain like obesity,

anemia and overexertion, much of its harmful effect may be avoided with proper care.

The pregnant cardiac patient should avoid, whenever possible, contact with anyone who has an upper respiratory infection. Acute respiratory infections in these patients should be treated promptly and vigorously with all the means at our command. This means complete bed rest at the onset of the cold, to be continued until complete recovery. Chemotherapy should be prescribed in small regular doses in an attempt at prevention of secondary complications. Antibiotics are indicated whenever secondary complications such as acute bronchitis seem imminent. Needless to say, adequate medical observation is important.

Opinions have conflicted in the past as to the harmful effects of too much childbearing upon the already damaged heart. Authorities now agree that parity alone has no influence upon the life expectancy of the woman with heart disease. As has been stated, pregnancy temporarily affects the cardiac reserve but has no effect upon the specific myocardial or valvular processes of rheumatic fever. True enough, cardiac decompensation may result from this diminution of cardiac reserve unless prenatal care is of the best. Women with chronic rheumatic heart disease who have had children live as long as those who have not. Domestic and economic factors of necessity play an important role.

Physicians are often misled by the belief that rheumatic cardiac patients who have gone through previous pregnancies without particular trouble should not anticipate trouble with succeeding pregnancies. Like most generalizations, it is not substantiated by facts because it ignores the progressive type of valvular impairment so characteristic of rheumatic heart disease. The valvular lesion may have progressed markedly since the previous pregnancy producing a decreased cardiac reserve. Even though the strain of pregnancy remains the same, decompensation results.

Case XII illustrates this point very well. An elderly multipara had mild decompensation with her fifth pregnancy. However, three years later at the age of forty-two she had severe cardiac decompensation and died in her sixth pregnancy.

Age is a most important consideration in these patients. The older the patient, whether pregnant or not, the more likely the possibility of cardiac breakdown. The reason for this is the usual progressive cycle from infection to death through which rheumatic fever passes. This disease process goes through four usually recognized phases: initial infection, recurrences, inactive period and the period of diminished cardiac reserve and failure. Most pregnancies occur in the third or so-called inactive phase with the result that the patient does well. In patients thirty years of age and older the likelihood of cardiac failure is greatly increased because the patient may be approaching the phase of diminished cardiac reserve. For that reason prognosis and management are considerably affected by the patient's age. All patients over thirty years of age require even closer observation than the younger group.

History, estimation of cardiac reserve and age have been mentioned as being most important in estimating prognosis. To these must be added the size of the heart. Although not as important as the others, it is of some value in prognosis. Changes in position of the heart secondary to pregnancy and possible hypertrophy makes estimations of heart size somewhat more difficult. If teleroentgenographic examination reveals the heart to be enlarged more than 10 per cent, prognosis is said to be adversely affected.

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Case XIV. The patient was a thirty-two year old multipara who had had four children previously without any prenatal, delivery or postpartum complications.

A mitral murmur had been noted three years prior to her last pregnancy. The prenatal course of this pregnancy was uncomplicated until the thirty-eighth week when pre-eclamptic toxemia developed, with a blood pressure of 150/90. The patient was placed on a low sodium diet and advised to rest. One week later she was admitted to the hospital in mild labor with a blood pressure of 180/90 and 2 plus albuminuria. Several hours later she went into acute cardiac decompensation. She was treated with morphine, atropine, digitalis intravenously, oxygen and a venesection. She did not respond and expired four hours later undelivered.

Autopsy findings included chronic rheumatic valvular disease, marked pulmonary edema and acute dilatation of left auricle and ventricle.

Questions. (1) Is mild toxemia a serious complication in pregnant cardiac patients? (2) Is the treatment of toxemia more difficult in pregnant cardiacs? What is the incidence of toxemia in these patients?

Answers. The development of toxemia in the pregnant cardiac patient, like an upper respiratory infection, may be the precipitating factor in the initiation of congestive heart failure. Toxemia usually occurs during the seventh and eighth months of pregnancy, during the time of maximum cardiac strain. Toxemia is associated with arterial spasm and as a result cardiac output is probably increased and certainly the cardiac load is heavier.

Treatment consists of immediate hospitalization even for the mildest cases. Improvement should be prompt, or else induction of labor is indicated.

In Case XIV a patient with a Class I cardiac condition without history of any previous cardiac difficulty had an uncomplicated antepartum course until the thirty-eighth week of pregnancy when the period of maximum cardiac strain was over. At that time pre-eclampsia developed and was treated with low sodium diet and rest. One week later, with the onset of labor, pre-eclampsia became severe with the patient rapidly changing from a Class I to a Class III cardiac. Congestive heart failure soon resulted in death. Hospitalization when toxemia first developed may have been followed with improvement or earlier induction of labor before cardiac strain became excessive.

The incidence of toxemia in pregnant cardiac patients is essentially the same as for all pregnancies.

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CASE XV. This patient was a thirty year old woman, gravida I, para 0. She had had a known congenital cardiac condition since birth the lesion being a patent ductus arteriosus. For years she had noticed considerable dyspnea and some cyanosis on exertion but was able to go to business daily. During the fifth month of pregnancy she was hospitalized because of increasing dyspnea, cyanosis and tachycardia. She remained in the hospital for the duration of the pregnancy under observation of obstetrician and cardiologist. Although at complete bed rest, her cardiac reserve diminished. She required intermittent oxygen administration during the last six weeks. In the thirty-eighth week mild pre-eclampsia developed as evidenced by blood pressure of 140/90, 2 plus albuminuria and 1 to 2 plus edema which did not respond to treatment.

Cesarean section was performed at term because of the persistent toxemia and unengagement of the vertex. Continuous spinal anesthesia was given using small doses of procaine. The patient tolerated this manipulation poorly and became very apprehensive. A rapid cesarean section was performed with the patient in Fowler position. She went into circulatory collapse immediately following delivery of the baby and expired before the operation was completed.

CASE XVI. A thirty year old woman, gravida II, para I, was admitted to the hospital in the thirty-seventh week of pregnancy for cesarean section. She had a congenital cardiac condition, the lesion being a patent interventricular septum. Her first pregnancy had resulted in a stillbirth secondary to premature separation of the placenta.

During the seventh month of this pregnancy mild decompensation developed and the patient was hospitalized for two weeks with marked improvement. For two weeks prior to operation she was again hospitalized for congestive failure and treated with digitalis and bed rest. Operation consisted of a classical cesarean section under local anesthesia which was well tolerated by the patient. Her postpartum condition was considered satisfactory so she was permitted out of bed on the fourth day. Her pulse varied from 80 to 120.

On the tenth day while preparing to leave the hospital she became apprehensive, dyspneic, cyanotic and developed Cheyne-Stokes breathing. She expired one and a half hours later. Death was attributed to acute cardiac decompensation.

Questions. (1) How frequent is congenital heart disease? (2) What is the best method of delivery for the patient with congenital heart disease? (3) How common is cardiac decompensation in the postpartum period?

Answers. Congenital heart disease is the second most common form of heart disease associated with pregnancy. Its incidence, however, is only 1.5 per cent. It can be said of congenital heart disease, even more than rheumatic heart disease, that most obstetricians and internists are quite aware of the deficiency

of their clinical experience in the management of these patients. To accumulate the necessary information required for intelligent management of pregnant women with heart disease, internists have found it necessary to study large series of cases. The importance of cardiac clinics for pregnant women in the larger hospitals must be emphasized. In smaller hospitals where a clinic is not feasible one member of the medical staff should devote time and study to this problem if our results are to improve.

All that has been said about functional cardiac capacity in rheumatic heart disease holds true for congenital heart disease. There is no reason for believing that pregnancy can permanently affect congenital heart disease. The risk of congestive failure is the same as in other forms of heart disease. The two most serious forms of congenital heart disease are patent ductus arteriosus and patent interventricular septum. Cyanosis affects the prognosis unfavorably, especially if it becomes more pronounced as the burden of pregnancy increases. Toxemia is perhaps even more serious than in the rheumatic cardiac patients. The hypertension associated with toxemia may make itself felt directly upon the pulmonary circulation through the congenital defect. When pre-eclampsia is present, as in Case xv, early interruption of the pregnancy is indicated. This case also presented a cause of death which is peculiar to congenital cardiac patients, that is, circulatory collapse immediately following delivery. The arteriovenous shunt which is present through the congenital defect may become a venous-arterial shunt immediately after delivery and cause circulatory collapse and death. The presence of hypertension prior to delivery increases the risk of this accident.

The last case (xvi) presents the common problem of chronic decompensation which was poorly managed. The patient was hospitalized in congestive failure and then discharged only to be readmitted with a more severe type of decompensation (as should be expected). Delivery was by cesarean section (a poor procedure) performed at the thirty-seventh week (a poor time).

Despite all of this, it is stated that the patient tolerated the operation well and was doing nicely until the tenth day when she died of congestive heart failure while preparing to leave the hospital. Acute heart failure such as this in the postpartum period is not infrequent. It may occur immediately after delivery and be the result of pre-existing anoxemia.

When congestive failure occurs from the second to the fifth day, it may be the result of hydremia secondary to beginning diuresis. Occurring on the tenth day as in this case we can assume it was due to overexertion. These patients should be kept in bed for ten days to two weeks postpartum. There is no place for early ambulation in the treatment of the pregnant cardiac patient.

The same contraindications to cesarean section are present in congenital heart disease as in the rheumatic type.

CONCLUSIONS

1. Heart disease is rapidly becoming the most frequent cause of death associated with pregnancy.
2. Prognosis and treatment depend on cardiac reserve, occurrence of previous decompensation, age and size of the heart.
3. All Class III and IV cardiac patients are to be hospitalized early in pregnancy.
4. Heart disease is never an indication for cesarean section.
5. Lowered mortality rates will result from proper prenatal care.

Practical Surgical Suggestions

SPECIAL USES OF THE SILVERMAN BIOPSY NEEDLE IN OFFICE PRACTICE AND AT OPERATION*

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ALTHOUGH biopsy needles have been used extensively by internists to obtain liver tissue, their possibilities have not been exploited fully by surgeons. The purpose of this article is to call attention to the uses of the Silverman needle for obtaining biopsies both in the office and at the time of operation. We have found it particularly useful in obtaining tissue from the thyroid in the office and from the pancreas at the time of operation. (Figs. 1 and 2.)

1 2 3

FIG. 1. Needle biopsy thyroid gland. Note the foreign body giant cells adjacent to acini filled with colloid. Diagnosis was subacute thyroiditis, × 70.
FIG. 2. Needle biopsy of pancreas. Diagnosis was adenocarcinoma, × 70.
FIG. 3. Needle biopsy of pelvic mass obtained through vaginal wall. Diagnosis was carcinoma simplex, × 70.

This needle differs from most punch or aspiration biopsy needles in that it has a split stilette that cuts and retains a core of tissue.[1] This core is about the diameter of the lead of a pencil and may be several centimeters in length. The tissues are not smeared, compressed or distorted and their normal architecture is not impaired. (Fig. 3.)

The technic of using the needle consists of the following seven steps: (1) infiltration of procaine and nicking of overlying skin, (2) insertion of the needle into the tumor tissue, (3) removal of the solid stilette, (4) insertion of the cutting blades into the tissue ahead of sheath, (5) advancing the sheath over the cutting blades to trap the core of tissue, (6) rotation of the sheath and blades through a 90-degree angle to break off the core of tissue and (7) withdrawal of needle and blades with contained core of tissue.

Although excellent biopsies of most neoplasms can be obtained with this needle, we have had difficulty in obtaining good biopsies of soft tumors which are deficient in stroma, of hyperplastic goiters and of colloid goiters. It is also difficult to obtain sufficient tissue from a lymphoma to enable the pathologist to study its architecture and establish a definite diagnosis.

The needle has been of special value in establishing the diagnosis in cases of suspected thyroiditis. Usually in subacute thyroiditis and often in struma lymphomatosa excellent specimens can be obtained and definite tissue diagnoses established by needle puncture performed in the office. No visible scar is left, there

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is little discomfort and no complications have occurred.

Satisfactory biopsies of inoperable thyroid cancers also can be obtained by this method, and the ability of these tumors to take up radioactive iodine can be studied if a tracer dose is given before biopsy and radioautographs are made of the specimen removed.

Although good biopsies of tumors of the breast and of most cancers can be obtained by the needle, its use is strongly contraindicated in operable carcinomas unless the surgeon is prepared to proceed immediately with excision of the cancer and the tract of tissue through which the needle was inserted. Proof of this point was established by the development of a local recurrence of a carcinoma of the thyroid in the skin and subcutaneous tissue at the site of a needle biopsy. The patient had a hard tumor of the thyroid and a large nodule in the lateral cervical region. A diagnosis of carcinoma of the thyroid with metastasis was made and the patient was urged to have it removed surgically. The patient, however, doubted the diagnosis and refused operation as the tumor had been present for several years and was not enlarging. He did, however, consent to needle biopsy; and when histologic proof of the nature of the tumor was available, he submitted to operation. Within a year he returned with a small nodule in the skin and subcutaneous tissue at the site of the biopsy. Excision of this nodule established the diagnosis of implanted carcinoma.

This biopsy needle has been useful in obtaining tissue from nodules in the liver either at the time of operation or during peritoneoscopy, with the biopsy needle inserted over the liver and visualized through the peritoneoscope.

At the time of operation the Silverman needle is of special value in obtaining tissue from the pancreas. Conventional biopsies of the pancreas are notoriously unsatisfactory because (1) tumors of the pancreas are apt to lie deep; (2) superficial biopsies which fail to obtain tumor are apt to show misleading evidence of chronic inflammation; (3) the pancreas is vascular and (4) pancreatic fistulas are apt to occur if deep biopsies damage an obstructed duct. The needle allows the surgeon to take several biopsies at any depth that he chooses without danger of incurring hemorrhage or significant leakage of pancreatic juice. A single suture will control any oozing of blood or secretions.

Since radical pancreatico-duodenectomy for carcinoma of the pancreas is a serious operation involving a relatively high mortality and morbidity, since its chances of curing a carcinoma of the pancreas are slight, and finally since pancreatitis may be indistinguishable from carcinoma, it is essential that a tissue diagnosis be established by frozen section before a radical operation is undertaken. This can be done safely and effectively in almost all cases by use of this needle.

TABLE 1

Sites	No.	Needle through Skin	Needle in Conjunction with Exploration	Needle and Peritoneoscopy
Liver	30	11	9	10
Thyroid	25	23	2	0
Pancreas	11	0	11	0
Miscellaneous	34	31	3	0
Total	100	65	25	10

RESULTS OF 100 CONSECUTIVE NEEDLE BIOPSIES

A positive diagnosis was made in seventy-five of 100 consecutive needle biopsies, covering a wide range of anatomic sites. In an additional eight of the 100 cases a microscopic opinion of no pathologic diagnosis was given. This latter category included those cases with a satisfactory biopsy specimen but without definite histologic abnormality. Seventeen of the 100 biopsies were reported as insufficient tissue for diagnosis. It is significant that in 83 per cent of the entire series a tissue specimen was obtained by needle biopsy of sufficient size and histologic integrity to render possible a microscopic diagnosis.

Sixty-five of these 100 biopsies were obtained through the skin with only the usual small puncture incision; twenty-five were obtained in conjunction with a surgical exploration; and the remaining ten consisted of liver biopsies utilizing peritoneoscopic visualization. (Table 1.)

Of particular interest has been a series of twenty-five biopsy specimens of the thyroid obtained in this manner. Twenty-three of these were procured in the office by passing the needle directly into the gland through a small nick

in the skin. In two other cases the needle biopsy specimen was obtained at the time of surgical exploration. A positive diagnosis was made on microscopic examination in fifteen of the twenty-three cases in which the needle alone was used. In two others of this group thyroid tissue was obtained but disclosed no definite pathologic lesion. In six of these twenty-three needle biopsy specimens an insufficient quantity of tissue was received for histologic evaluation. In the seventeen cases in which a satisfactory amount of tissue was obtained results were as follows: malignant tumor, five; thyroiditis, six; hyperplasia of thyroid, two; adenoma, two and no pathologic diagnosis, two.

The practical value is manifest. In several cases the biopsy confirmed the diagnosis of thyroiditis of a type amenable to treatment with irradiation. In this way the necessity of exploring the neck surgically for the purpose of obtaining a biopsy was avoided and replaced by an office procedure. On one occasion the biopsy showed carcinoma in a case in which the clinical diagnosis of thyroiditis had been made.

Needle biopsies of the pancreas were performed in eleven cases. These biopsies were obtained from the subcapsular depths of the pancreas at the time of laparotomy and the following were reported from the needle specimens: carcinoma, five; chronic inflammation, four; normal pancreas, one (no pathologic diagnosis) and insufficient tissue, one. (A follow-up study on the case reported as no pathologic diagnosis has disclosed no recurrence of symptoms following the laparotomy.)

If the first biopsy fails to reveal carcinoma in a case in which malignancy is suspected, additional biopsies should be taken until all involved areas have been sampled.

SUMMARY

1. The Silverman biopsy needle can be used in the office to obtain tissue from superficially located tumors and organs.

2. The needle is particularly useful in obtaining biopsies of the thyroid in suspected cases of thyroiditis.

3. The needle can be used to obtain biopsies of the liver during peritoneoscopy. During laparotomy it is of special value in obtaining satisfactory biopsies of the pancreas.

4. Since needle biopsy is capable of implanting tumor tissue, biopsies of operable tumors should not be taken unless the surgeon is prepared to proceed immediately with excision of the tumor and the tract through which the needle was inserted.

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TRANSVERSE ABDOMINAL INCISIONS IN UROLOGIC SURGERY*

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THE use of transverse incisions in abdominal surgery has been advocated by an increasing number of general surgeons in recent years. Although some urologists have been utilizing transverse abdominal incisions almost routinely, by far the greater percentage still adhere to the standard vertical or longitudinal incision. For the past few years we have employed transverse incisions for various urologic procedures on the abdomen and have been impressed by the superiority of this surgical approach. This is due to three significant factors, namely, improvement of exposure, lower incidence of postoperative complications and much stronger healing of the abdominal wound.

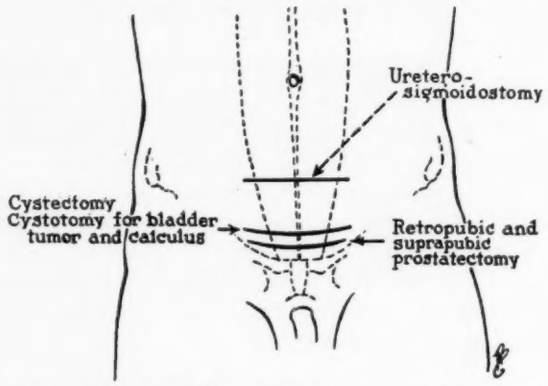

FIG. 1. Diagram illustrating transverse abdominal incisions for urologic procedures.

We have used transverse incisions for the following urologic procedures (Fig. 1): (1) suprapubic operations (one-stage suprapubic prostatectomy, retropubic prostatectomy, cystotomy for calculus or tumor, cystotomy as a preliminary procedure for transurethral resection, diverticulectomy, cystectomy, total or segmental); (2) transperitoneal nephrectomy; and (3) bilateral ureterosigmoidostomy.

Suprapubic Operations. The technic followed for each of the suprapubic operations listed heretofore is essentially the same except for a few variations depending upon the degree of exposure required. In doing a retropubic prostatectomy or cystectomy adequate exposure of the space of Retzius is mandatory. This is best accomplished by two maneuvers: (1) elevation of the pelvis by the kidney rest and (2) incision of both recti at their insertion to the symphysis as described by Cherney[1] and Smith.[2] The use of the kidney rest or a sand bag placed under the pelvis at the level of the symphysis has been described by us[3] in a previous publication. This maneuver opens up the space of Retzius, elevates the deepest portion of the pelvis and provides the additional exposure resulting in a much easier operative procedure. It is important that the upper edge of the kidney rest lie exactly at the level of the upper border of the symphysis.

Cutting the rectus muscles transversely at their insertion to the symphysis is also of great aid in obtaining proper exposure. In obese patients the recti may be cut across almost completely but in the average individual an incision ¼ to ½ inch long is usually sufficient. For those suprapubic operations such as the one-stage suprapubic prostatectomy or cystotomy in which deep exposure of the pelvis is unnecessary the recti need not be cut.

For retropubic or suprapubic prostatectomy the skin incision is made approximately ¼ inch above the upper border of the symphysis. (Fig. 2A.) In individuals with an obese abdomen the incision should follow the skin crease just above the symphysis where the layer of subcutaneous fat is thinnest. For cystectomy, cystotomy or diverticulectomy the incision may be made slightly higher, about ¾ inch above the symphysis. The skin incision should be approximately 4 to 5 inches long and is slightly curved with the convexity downward following the natural contour of the lower abdomen. At each end of the incision the superficial epi-

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gastric vessels are usually exposed and should be clamped, cut and ligated. These vessels serve as a convenient landmark to indicate the lateral limits of the incision. The transverse incision is continued through the subcutaneous fat, the anterior sheaths of the recti and the medial portion of the aponeurotic extensions of the flat muscles. The upper flap of the anterior rectus sheath is grasped with a forceps and is freed with a scissors or knife for about 1 inch from the anterior surface of each rectus. The lower flap of the anterior rectus sheath is freed in a similar manner down to its attachment to the pubis. The lower flap is then incised in the midline down as far as the symphysis. (Fig. 2B.) The latter step serves to give maximum exposure in the space of Retzius and is indicated only for retropubic prostatectomy or cystectomy.

At this stage the two recti with the overlying pyramidalis muscles are exposed, separated in the midline and retracted laterally. The insertion of the rectus and pyramidalis to the symphysis on each side is incised transversely for ¼ to ½ inch depending upon the obesity of the patient and the degree of exposure required. (Fig. 2C.) This allows the recti to be retracted laterally with great ease and minimal trauma. A self-retaining abdominal retractor is placed into the wound to maintain the lateral retraction of the recti and the entire suprapubic and retropubic area is widely exposed.

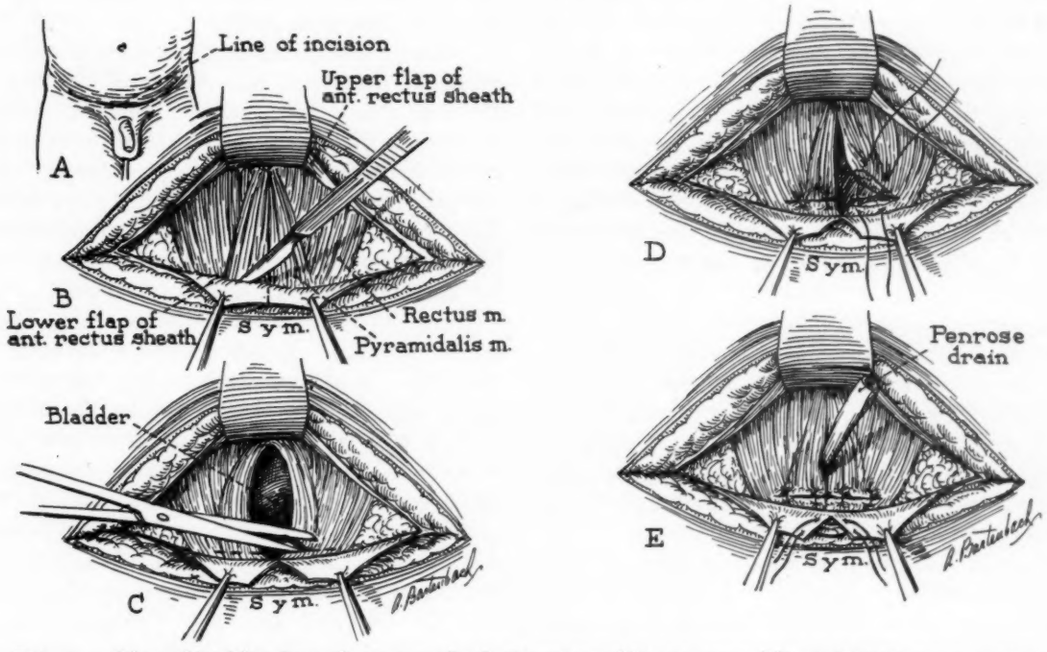

FIG. 2. A, Line of incision just above symphysis for retropubic or suprapubic prostatectomy. B, rectus sheath has been incised transversely. Upper flap of rectus sheath has been freed from rectus muscles. Lower flap is being freed. Dotted line in lower flap indicates line of incision to be made down to symphysis. C, pyramidalis and rectus muscles separated in midline to expose bladder. Insertion of recti to symphysis will be incised transversely along indicated dotted lines. D, closure of incised rectus and pyramidalis muscles with interrupted sutures. E, incised rectus and pyramidalis muscles closed. Penrose drain in space of Retzius. Midline incision in lower flap of rectus sheath being closed with interrupted sutures.

Closure of the wound is accomplished with interrupted sutures of No. 1 chromic catgut. The proximal cut ends of the recti usually retract slightly but can be brought down without tension if the abdominal wall is relaxed. The proximal end of each rectus and pyramidalis is sutured to the small distal tendinous segment so as to include a portion of the fascia inserting into the pubis. Two or three interrupted sutures are sufficient to approximate the cut ends and re-establish a firm continuity of the muscles. (Fig. 2D.) A Penrose drain is then placed down in the space of Retzius between the recti. The midline incision of the lower flap of the rectus sheath is sutured with interrupted No. 1 chromic catgut. (Fig. 2E.)

The transverse incision of the rectus sheath is closed in a similar fashion.

In performing cystotomy, diverticulectomy and one-stage prostatectomy the cystotomy tube should come out through the fascia and skin about 1½ inches above the operative incision. The upper leaf of the rectus sheath is held up by a forceps and a small stab incision is made through the skin and fascia 1½ inches above the original incision. A curved forceps is inserted through the stab wound and the end of the cystotomy tube is grasped and pulled through. After the cystotomy tube is removed, the urinary fistula is more apt to close after a much shorter period of time because the fistulous tract is separate from the original skin incision.

Transperitoneal Nephrectomy. The transperitoneal approach for removal of kidney tumors is an established procedure and has definite indications. We have utilized the transverse abdominal incision for this operation and have found it to be especially useful with tumors arising from the lower pole. The most striking advantage of this approach is the excellent exposure of the renal pedicle and vena cava so that any damage to these structures which may occur with infiltrating neoplasms can be easily visualized.

The skin incision is made at the level of the twelfth rib and extends from the lateral border of the rectus to the lower border of the twelfth rib. The incision is carried down through the subcutaneous fat, the lateral portion of the anterior rectus sheath and the fascia of the external oblique. The internal oblique muscle is split transversely and the transversalis fascia and peritoneum are opened transversely. In obese individuals it may also be necessary to cut the rectus muscle across in its lateral portion. A self-retaining abdominal retractor is placed into the wound and the abdominal cavity is exposed. The small intestines are carefully packed off medially and held back with large Deaver retractors. This will expose the large bowel with the kidney easily palpable laterally. The large bowel is retracted medially and a vertical incision is made through the parietal peritoneum overlying the kidney. The parietal peritoneum is separated from the underlying kidney and the large bowel is packed off and retracted medially. The kidney is freed from the surrounding tissues in the usual manner after the ureter and, if possible, the renal pedicle has been exposed. We have attempted to ligate the renal pedicle before manipulating the kidney but with large infiltrating tumors this has not been feasible. However, the pedicle may be very well exposed if care is taken to retract the large bowel and peritoneum medially and the surrounding fatty tissue is dissected away.

Before closing the incision a stab wound is made in the flank into the renal fossa and a Penrose drain is inserted. The parietal peritoneum is closed over so that the entire renal bed is extraperitonealized and drained through the extraperitoneal stab wound in the flank. The transverse abdominal incision is closed in layers using continuous No. 1 chromic catgut for the peritoneum and fascial layers.

Bilateral Ureterosigmoidostomy. The skin incision is made about halfway between the symphysis and umbilicus in the center of the abdomen. The incision should be approximately 5 to 6 inches long depending upon the obesity of the patient. The subcutaneous fat and anterior rectus sheath are incised transversely and the recti are exposed. Each rectus muscle is divided transversely for about three-fourths of its width. The deep epigastric vessels may be exposed and are clamped, cut and ligated. The posterior sheath and peritoneum are incised transversely and a self-retaining abdominal retractor is placed into the wound. The patient is put in Trendelenburg position so that the small intestines may be easily packed into the upper portion of the abdominal cavity. Both ureters and the sigmoid can be easily visualized through this approach because of the excellent exposure obtained. The wound is closed in layers using a continuous No. 1 chromic catgut suture for the peritoneum and posterior rectus sheath. The anterior rectus sheath is closed with interrupted No. 1 chromic catgut sutures. It is unnecessary to approximate the cut ends of the recti since suturing the anterior and posterior sheaths will bring the recti together.

COMMENTS

The suprapubic area is very vulnerable to the development of postoperative weakness and diastasis of the recti because there is only one strong fascial layer present, the anterior rectus sheath. We have been impressed with the strength of the healed suprapubic wound, especially in the old and debilitated patient, when

a transverse incision has been employed. Since the fibers of the anterior rectus sheath course in a transverse direction, a transverse incision is parallel to the line of greatest stress so that any increased abdominal tension will tend to approximate the edges of the incision. This allows the patient to move about in bed or become ambulatory with a minimum of discomfort and results in a firmer scar because of the lack of tension on the wound during the healing period.

Cutting the rectus muscles at their insertion to the symphysis is not followed by weakness because each rectus is very firmly attached to its anterior sheath by the tendinous insertions along its course. The cut ends of the rectus can retract only for a short distance because of these insertions, and when the anterior sheath is sutured, the ends of the rectus muscle are approximated.

The importance of preserving the nerve supply to muscles and fascial structures is well known in regard to proper healing of operative wounds. Since the structures of the anterior abdominal wall are innervated in a segmental manner, the least number of nerve trunks will be severed with a transverse abdominal incision.

The improved exposure obtained with the use of a transverse incision is an important factor in reducing the trauma incident to any operative procedure. Prolonged retraction of muscles is unnecessary, with a resultant decrease in the degree of trauma to all supporting structures. By avoiding the thick portion of the subcutaneous fatty layer when using a transverse incision for suprapubic operations damage to the adipose tissues with possible necrosis and infection is minimized.

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HOMEMADE PROCTOSCOPIC TABLE*

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A SATISFACTORY proctoscopic examination is seriously influenced by the position of the patient during the examination. The ideal position for proctoscopic examination is one in which the head of the subject is lowered so as to permit the bowel to slide out of the pelvis and thereby create a negative intra-abdominal pressure. A knee-chest position without constriction of the abdomen satisfies this requirement. More often than not, however, it is extremely difficult to make a patient understand how to get into such a position and still more difficult to get him to maintain this position during the examination. More time is frequently expended in positioning the patient than in examining him. In order to avoid this recurring nuisance of positioning during proctoscopic examination, a specially designed proctoscopic table was felt to be desirable. In designing this table an attempt was made to satisfy the following requirements: (1) The table should be so designed that it is impossible for the patient to get on it except in the proper position for proctoscopic examination. (2) Once on the table and in the proper position it should be impossible for the patient to alter his position readily. (3) The table must be sturdy, steady, safe and comfortable to use. (4) It must be convenient for the operator. (5) It should be constructed from materials which are cheap and readily available.

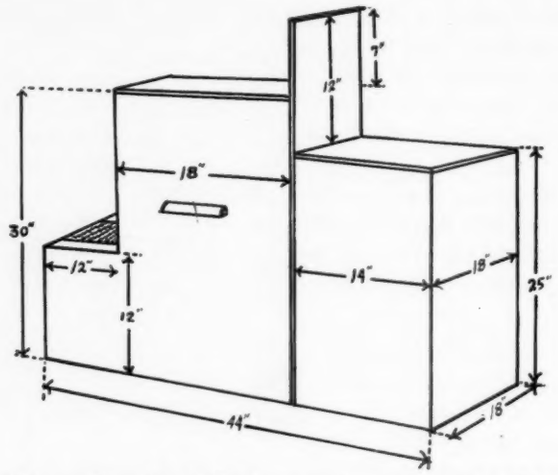

FIG. 1. Drawing of the homemade proctoscopic table giving the various dimensions. This is an alternate design from the one photographed, in that the plywood sides are extended to support the head rest instead of using a prop.

The table to be described has been designed to meet the aforementioned requirements. It can be constructed by anyone with ability in elementary carpentry from supplies often found in surplus in hospital supply rooms. It is readily used even by aged and arthritic patients without causing inconvenience. It has markedly

* From the General Surgical Service of the Veterans Administration Hospital, Omaha, Neb. Sponsored by the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the author are a result of his own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

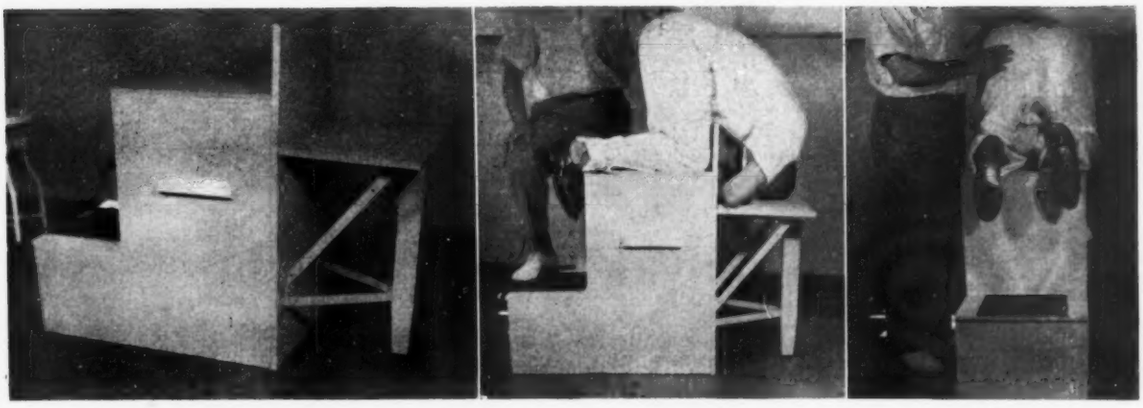

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FIG. 2. Photograph of table. Note the simple construction. The foam rubber pads are the same as those used in orthopedics for padding casts. The table is remarkably light in weight and occupies very little floor space.
FIG. 3. A and B, Table photographed with a subject in position. Note the good position of the subject and the convenience to the operator.

reduced the time used in doing proctoscopic examinations.

Figures 1 to 3 are largely self-explanatory. The handles on the side of the table are put there for convenience in moving. The rubber stair tread on the first step prevents slipping. A ½ inch foam rubber pad is used on the platform for the knees as well as on the head rest which makes the table comfortable to use. The guard fence prevents the patient from crawling forward but it should not be high enough to constrict the abdomen. The head rest needs floor support to prevent the table from toppling forward. This support can be given by means of a post as shown in the photographs or by extending the sides of the table as shown in the drawing. The sides are made of ¼ inch plywood and the guard fence of 1 inch lumber.

TRANSFUSION TECHNIC REGARDING THE PREVENTION OF ANURIA*

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THE term anuria is used here to include oliguria, as anoxia is generally taken to mean hypoxia. During a twelve-month period four or five cases of postoperative anuria were seen at this hospital. Abbott intravenous sets are used here. When the last few drops of a bottle of blood run in, the saline with which the blood is connected invariably becomes colored throughout with blood. It has been my practice before starting a second pint of blood in the operating room to remove the bloody saline and substitute for it a fresh bottle. In this way there is little or no mixture of donors' bloods. During the following twelve-month period, while this technic was in use, there were no cases of postoperative anuria.

It is conceivable that two donors hematologically compatible with a patient may not be compatible with each other. Through the kindness of the Department of Pathology at this hospital donors' bloods to be used in elective surgery here will henceforth be cross matched with each other as well as with the patient's own blood, in selected cases, so that we may test this hypothesis. When the blood of four donors has been set aside for an operation, this will require ten cross matchings instead of the usual four.

I do not know what part of postoperative urinary suppression may be due to this mechanism, nor if it is the practice of most other anesthetists to allow donors' bloods to mix or not. Several anesthetists to whom I have spoken in this connection have told me that it did not occur to them to take this precaution but that they merely added a second (and third) bottle of blood in turn to the same bottle of saline.

It is my belief, supported only by the evidence I have given, that preventing donors' bloods from mixing is a valuable procedure in connection with the elimination of postoperative anuria.

* Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the author are the result of his own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

Bookshelf Browsing

STEPPING STONES TO SURGICAL ANESTHESIA

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THE centennial of the official discovery of surgical anesthesia was observed on October 16, 1946. This is a day long to be remembered and honored as not only that eventful day when William T. G. Morton first demonstrated to the world that ether could be used with safety to produce insensibility to the pains of surgery but also as the day mankind first began a truly scientific program in its search in the realms of surgical anesthesia. Obviously then, this was a major discovery; a discovery that was to revolutionize surgery and delightfully enhance the brilliance of the various radiant beams emanating from this our golden age of medicine.

Much has been said and written during the past 100 years regarding this subject, America's greatest contribution to the advancement of medical knowledge, but nothing has been written, said or thought that does not bear reiterating forever. Although nothing new in historical detail is exposed in this paper, several literary gems associated with the birth and development of the blessed phenomenon of surgical anesthesia are exhibited herein and many others discussed. Its prime purpose is to acquaint the reader with some of the relevant works of the eminent physicians and surgeons of the past century who devoted hours of toil and struggle to give to it the very life blood that it needed in order to survive. Now that the centennial of their first successful efforts at solving the outstanding problem of centuries has past, it is fitting to commemorate the event by permitting these men to live again through their outstanding works and famous words.

A better comprehension and appreciation of the real significance of anesthesia may be gleaned from some reflection upon the suffering of humanity during those torturous pre- and early anesthesia days. Those who take the anesthesia part of the operation more or less for granted should read the stirring words of J. Mason Warren[1] in his "Surgical Observations": "The change made in the practice of Surgery by the discovery of the anaesthetic power of ether can scarcely be appreciated by those who have come on the stage since the introduction of this agent. Nothing short of astonishing that a patient would subject himself to the inevitably painful struggle or that surgery was practiced at all in those dreadful days before anaesthesia." How utterly unfamiliar we are now with the hazardous and dreadful torments in the life of the doctor in those courageous days when for an amputation, for instance, "he first dosed the patient with brandy, opium and henbane to deaden the pains then numbed the nerves with a tourniquet, strapped the man on the table with the good leg fastened down; and, while working fast with knife, nippers and saw, binding blood vessels with wax thread; in order to divert the poor devil, the doctor urged his family to shout and sing and make plenty of noise. In bloody bedlam the job was done."[2] One just had to be rugged to take as well as give it, notwithstanding the fact that operative speed and sleight of hand dexterity was the test of a good surgeon and truly the most essential factor in his success. All kinds of letters from both patients and doctors testify to the inconceivable tortures of those bound to the operating table. "Before the days of anaesthetics a patient preparing for an operation was like a condemned criminal preparing for execution. He counted the days until the appointed day came. He counted the hours of that day till the appointed hour came. He listened for the echo in the street for the surgeon's carriage. He watched for his pull of the door-bell, for his

foot on the stair, for his step in the room; for the production of his dreaded instruments, for his few grave words, and his last preparations before beginning. And then he surrendered his liberty and revolting at the necessity, submitted to be held or bound, and helplessly gave himself up to the cruel knife."[3] Many times it was the profound shock of pain and physical and mental exhaustion that actually permitted the operation to be brought to its conclusion. "Of the agony it occasioned I will say nothing. Suffering as great as I underwent can not be expressed in words; and thus fortunately can not be recalled. The particular pangs are now forgotten; but the black whirlwind of emotion, the horror of great darkness, and the sense of desertion by God and man, bordering on despair, which swept through my mind and overwhelmed my heart, I can never forget, however, gladly I would do so." Thus spake a patient in those preanesthesia days when the sights of the operating room were so abhorring that many a physician gave up the practice of medicine entirely as Charles Darwin did after he witnessed an operation on a child. Not only was it a nightmarish, terrifying occasion for the patient but also a dreadful ordeal for the surgeon. Most surgeons actually dreaded the undertaking fully as much as their patients. Cheselden, with his sleepless nights before an operation, remarked, "No sufferer can ever be more terrified than I am on these occasions." Is it any wonder that heretofore surgery was the craft of the uncultured, cruel and ignorant groups? Up until the 17th century surgery had no restriction in its personnel; it was a free-for-all trade in which anyone who desired to wield the knife could do so. Therefore, the application of ether in producing insensibility to pain is a boon to the patient, surgeon and surgery alike, for which all obviously are eternally grateful.

John C. Warren[4] in his book states concisely the surgeon's feeling: "What surgeon is there who has not felt, while witnessing the distress of long painful operations, a sinking of the heart to which no habit could render him insensible! What surgeon has not at these times been inspired with a wish to find some means of lessening the sufferings he was obliged to inflict. . . . No words can more fully or better declare the gratitude this surgeon feels for the new era opened to the operating surgeon in which he no longer has to listen to the agonizing screams that he had become so accustomed to hear."

From time immemorial such feelings have played on surgeons' minds and led to trial after trial of various agents for producing insensibility. Any analysis of the dramatic struggles of the human race with its survival of the fittest will reveal its ever present, almost superhuman unscientific efforts to conquer physical suffering and human pain. In this age of sulfonamides and wonder drugs it is difficult for us to realize how many of our most valuable drugs and remedies are results of primitive ideas and methods of many hundreds of years ago. Gordon put it aptly: "The world is inclined to look upon primitive man as entirely devoid of intelligence and spending his life fishing, hunting and fighting when as a matter of fact, he did yeoman service in blazing surgical, pharmaceutical, and biological trails for the benefit of posterity." How unappreciative we are of the fact that to him, primitive man, must go the credit for opening up to us the "Great chemical workshops of nature" in the roots, barks and herbs that are so readily recognized even in the medicines of today. Man found the great gift of artificial sleep encapsulated in the scent, seeds and sap of various plants, especially the poppy, mandragora, Indian hemp and so forth. From earliest times some means have been known and used to render the human body insensible or less sensible to pain during surgery. Well might this be so when it will be noted that primitive surgeons used crude knives and other such instruments. The early surgical instruments were flint stones and sharp bivalvular and triangular clam and other sea shells; ostensibly fearsome, dreadful and awe-inspiring objects of torture, all of which necessitated an ever searching, never ending effort on the part of the surgeon to discover better means and greater ways of alleviating the accompanying pains. It would surely seem in the height of desperation or more certainly insanity for any surgeon today to expectorate knowingly in a wound, but with a method in his madness the early Inca Shaman recognized in trephining the skull the soporific effect of extracts of cocoa leaves made by chewing the leaves and allowing the saliva to drop upon the bashed-in area of the skull to be excised. The goddess Aphrodite on Mount Ida and an Egyptian prince in the Nile Valley are alleged to have found relief

from pain by sleeping upon a bed of poppies while the Egyptian sun god, Ra, is considered to be the first to administer mandragora as a soporific. This substance is one of the most ancient of herbal remedies and is still common in the Mediterranian area. "Such herbs come down to us from the most ancient times, three eras before the Gods were born," so related the Rig-Veda. Pliny, the naturalist who perished in the destruction of the Herculaneum in 79 A.D., spoke convincingly of the anesthetic effects of mandragora: "It has a soporific power on the faculties of those that drink it; the ordinary portion is half a cup. It is drank against serpents, and before cutting and puncturing, lest they should be felt." Notwithstanding the fact that a Babylonian tablet of 2250 B.C. reveals a local anesthetic of a powdered henbane cement for dental caries, probably the earliest known reference to real surgical anesthesia appeared during the 1st century A.D. from Dioscorides, the great physician of Cilicia in Asia, who spoke of boiling in wine either the roots or the bark of mandragora and poppies, the juice of which can cause the insensibility of those who are cut or cauterized. "They do not apprehend the pain because they are overborne with deep sleep." Similarly, Indian hemp was used by Scythians, Egyptians, Arabians and even in the 3rd century, during the Wei dynasty of China, by the famous physician, Hoa Tho, in a concoction to produce a sleep in one so profound as to be considered dead drunk. In the 5th century in the second oldest book of the Jews, "The Talmud," a sleep potion, "Sama deshanto," is mentioned without disclosing its identity. Sometime during the middle ages various "spongia somnifera" came into existence; at first they were prepared by monks, the better known being the medieval saint, St. Benedict, who put Emperor Henry II to sleep on a mandragora pillow before amputating his leg. Later, however, in the 10th century two surgeons of Bologna, much ahead of their time, became real pioneers in anesthesia; they, Ugo Borgononi, known as Hugh of Lucca,[6] and his son, Theodoric, described and prescribed the inhalation of an anodyne vapor in the form of a true "spongia somnifera" made by taking opium and the juice of unripe mulberry, of hyoscyamus, juice of hemlock, juice of the leaves of the mandragora, juice of the woody ivy, juice of forest mulberry, seeds of lettuce, seed of the burdock which has a large round apple, and water hemlock, each 1 ounce; "mix the whole of these in a brazen vessel and then in it place a new sponge and let the whole boil as long as the sun on the dog days till it (the sponge) consumes it all and let it be boiled away in it. As often as there is need of it place this same sponge into warm water for an hour and *let it be applied to the nostrils* till he who is to be operated on (gin incidentus est) has fallen asleep. When this is finished in order to arouse him place another dipped in vinegar frequently to his nose, or let the juice of the roots of fenigreek be squirted into his nostrils. Presently he awakens." Thus inhalation anesthesia had its rather crude beginning and for the moment a rather unknown success. During the 12th century a monk concocted the "potion of oblivion" which in all probability is similar to the "letargion" of Scotland which although unknown was undoubtedly a concoction of opium and hyoscyamus. The ingredients of "lethargion" known only as a composition of various hypnotic drugs remained essentially a secret from physicians and barber surgeons alike; hence they and their patients became remarkably skeptical and prejudiced against these soporifics which could so readily cast one into an eternal sleep. Not being the days of scientific research, scientific assay and standardization, the conscientious would not take unnecessary liberties with the herbal drugs and their undetermined and incalculable effects. Consequently, anesthesia of this type fell into disrepute and disuse. For many years the memorable struggle against pain continued but, as has been indicated, little of real scientific value had been achieved from any source whatever, be it Babylonian, Greek, Oriental, Asiatic or European. However, in the 13th century, as the haziness of the nebulous Middle Ages began to clear, Raymond Lully is credited with having discovered in his alchemist shop a "white fluid" which he termed "sweet vitriol." This remained unsung and almost unknown for 200 years when that audacious but great physician, Theophratus Von Hohenheim, probably the first to associate chemistry and physiology in searching for a pain-relieving agent, distilled a mixture of sulfuric acid and alcohol to rediscover Lully's "sweet vitriol," not to be termed "ether" until another 200 years by Frobenius in 1730. The aggressive, bombastic Theophra-

tus Von Hohenheim proclaimed himself even of greater authority than Celsus, adopted the now famous name of Paracelsus and declared that no ancient authority was essential to the practice of medicine; the greatest authority was experience. Through his experience in experimenting with "sweet vitriol" on chickens and his report that "even chickens take it gladly, and thereafter fall asleep for a long time awakening undamaged, . . . its use may be recommended for painful illnesses," he has considerable evidence favoring him as the discoverer of "ether" as an anesthetic.

Fortunately, at this time a young man, Valerium Cordus, interested in collecting a record of all extant medicaments, met and dogged along with Paracelsus. Our knowledge of the various remedies used by him would have been extremely meager had it not been for the indefatigable efforts of this note taker who jotted down his every prescription, among which was the exact description of the synthesis of "sweet vitrial" or ether so named by Frobenius because of its alchemist origin. Right here was the golden opportunity for suffering humanity to obtain that long sought for agent for producing insensibility to pain, but it slipped into oblivion for a few hundred years more for no other reasons obviously than a failure to recognize and appreciate the true significance of the discovery as well as the almost insurmountable difficulty of disseminating the fragmentary and limited knowledge of the substance.

For the next three centuries, even though one might read about "ether," nothing very profitable was accomplished surgically with it, and physical pain and suffering ran rampant throughout the world unabated and almost unchallenged. Instead, humanity fell under the spell of trying to reconcile the new scientific advance with a renewed faith in miracles. It was more than a reversion to a singular faith in magic or religion; it was the development of a school of pseudoscientific speculators under the instigation of Franz A. Mesmer at a time when the credulity of mankind was such that almost any unorthodox method of healing might flourish with ease.

Usurping the scientific knowledge of magnetism and electricity, Mesmer advanced the idea of a "magnetic fluid" existing everywhere in the body which governs all its functions. This idea of vital force was his attempt to give a rational explanation for the miraculous means of healing by glance, word or touch, that is, by "suggestion." Mesmerists claimed that for a long time they had performed painless operations on persons in the cataleptic state induced by mesmeric influences. The following paragraph appeared in "The History and Philosophy of Animal Magnetism" Boston, 1843: "Dr. Shattuck of Lowell, has been very successful as a magnetizer and has made some new and valuable discoveries in the science. A large tumor was extracted from the shoulder of a lady whom he had magnetized at a public lecture in Lowell, without causing the slightest pain. The incision was made to the depth of two inches. This experiment was performed under direct personal inspection of three or four other physicians who admitted the astonishing insensibility of the patient."

Without further discussion of the prodigious amount of material written on Mesmerism and hypnosis, it can be certainly admitted for Mesmer at least he tried to establish his ideas on a scientific foundation; he is thus entitled to be considered one of the earliest psychotherapists. Nonetheless, from an anesthetic point of view most surgeons here and abroad were unsuccessful with this method; so, skepticism prevailing, except among the very few, it likewise shortly fell into disrepute and died a natural death.

The next real step in advance came about the time when need for ventilation and fresh air for houses was under consideration. At that time Joseph Priestly appeared on the horizon with his experiments with various gases which, although unknown to him at this moment, were eventually to be the very precursors and backbone of the discovery of modern anesthesia; he discovered carbonic acid, rediscovered 100 years after John Mayow what was to be called eventually oxygen, and in 1772 he became the first to provide a dependable artificial anesthetic by his discovering the pain-controlling gas, nitrous oxide. It remained, however, for Humphrey Davy in 1795, doubting the claims of Dr. S. Latham Mitchell to the effect that he had found it a lethal gas and a source of contagion in epidemics, to inhale the gas boldly himself and discover its pleasurable, giddy sensation. He published five years later the results of his studies in "Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide,"

etc. In this he made the breath taking, world-stirring statement oft since quoted, "As nitrous oxide in its extensive operation appears capable of destroying physical pain, *it may probably be used with advantage during surgical operations* in which no great effusion of blood takes place," which fell on deaf ears and went unheeded, there being no evidence that he or anyone tested out this theory for some time to come.

About this time the therapeutic value of ether became appreciated and discussed by Hoffman, Cullen, Alston, Lewis and Monroe, but its use by inhalation was given its first real impetus by a pamphlet published in 1795 by Dr. Richard Pearson. During the early 19th century much was published on this subject which undoubtedly influenced Wells, Morton, Jackson and others in their future experimental work on anesthesia. Dr. John C. Warren, who used the inhalation of ether for relieving the last stages of pulmonary inflammation in 1805, states in the early paragraphs of his work, "Etherization," "The general properties of ether have been known for more than a century, and the effect of its inhalation in producing exhilaration and insensibility has been understood for many years, not only by the scientific but by the young men in colleges and schools, and in the shops of the apothecary who have frequently employed it for these purposes." As early as 1812 it has been inhaled for its exhilarating effects by hundreds throughout the country in the so-called "ether frolics."

Nitrous oxide and ether had long been known to produce similar effects, for in 1818 as a result of his experiments Michael Faraday wrote in *The Quarterly Journal of Science and Arts*, "When the vapor of ether mixed with common air is inhaled it produces effects very similar to those occasioned by nitrous oxide." Hence after 300 years in the depths of oblivion the very discovery of Paracelsus in 1510 emerged once again only to sink back into the oblivious deep for a few more years. Not for so long, however, for Dr. Henry Hill Hickman, an ambitious, sympathetic, scholarly Englishman, convinced of the dire need of discovering a way of preventing pain of surgery (at a time when pain and the scalpel were considered inseparable), was determined to evaluate the work of Davy and Faraday by animal experimentation deliberately with the idea of discovering a gas which when inhaled would produce insensibility to pain. As a result of his experimentation on animals under carbon dioxide gas he published his now famous pamphlet[42] which was a masterly document of his experiments with carbonic acid and nitrous oxide on mice, dogs, chickens and so forth. This came to naught for him since, because Davy and Faraday were not interested in his efforts, none of the leading scientists of the continent would recognize the true worth of this contribution to medical science and especially to suffering humanity. What a dilemma; he obviously was a saddened victim of time and circumstances. Deeply disappointed and disillusioned, he died prematurely at the age of twenty-nine years in poverty and obscurity, just eighteen years before his country finally took up the cudgels on his behalf and produced his experiments as evidence that he was the real discoverer of anesthesia in surgery. Obviously, he would and should have been had they but heeded his voice crying in the wilderness a couple of decades sooner; however, since they did not, the best that can be granted him is the credit for having been the first to prove by animal experimentation that insensibility to pain of surgery could be produced by the inhalation of a gas.

Oddly enough during the next few years the inspiration to the discovery of surgical insensibility came as a by-product of witnessing "ether frolics" and "laughing gas parties." Although it was not disclosed during the ether controversy, probably the first real use of ether as an anesthetic on record took place in January, 1842, when (according to H. M. Lyman in his "Artificial Anaesthesia and Anaesthetics," 1881) a chemistry student, William Clark, because of much experience giving "ether entertainments," was permitted to administer ether from a towel to a Miss Hobbie in order that one of her teeth might be extracted by her dentist, Dr. Elijah Pope, at Rochester, N. Y. Similarly, as a result of his experiences in the past partaking of "ether parties" a young physician of Jefferson, Georgia, Dr. Crawford Long, seized the opportunity on the afternoon of March 30, 1842, of demonstrating the courage of his convictions by painlessly excising a tumor from the neck of a friend, James M. Venable, rendered insensible of pain by ether. For several reasons the account of this was not published until the December 1849 issue of *The Southern Medical and*

Surgical Journal, a little over three years after Henry Bigelow's report of Morton's discovery of 1846.

While watching Dr. Gardner Q. Colton giving an exhibition of the exhilarating effects of nitrous oxide gas the evening of December 10, 1844, at Union Hall in Hartford, Dr. Horace Wells noted that the young volunteer, Samuel A. Cooley, did not feel the pain of a bruised and lacerated leg sustained while jumping around under the influence of the gas until its effects had worn off. This gave Dr. Wells the inspiration to ask that Dr. Colton bring his gas bag to his office the next morning, December 11, 1844. This he did, at which time, while Dr. Colton administered the nitrous oxide Dr. Riggs, a colleague, was called in to extract one of Well's molars. On recovery the latter exclaimed, "It is the greatest discovery ever made! I didn't feel it so much as a prick of a pin!" It seemed like the dawn of a "new era in tooth pulling" as Wells continued to use the nitrous oxide with increasing success. He went to Boston to announce his discovery, going first to his former partner, William T. G. Morton, and then both went to visit the noted chemist, Dr. Charles Jackson, who thought the proposed idea was too hazardous and dangerous; Wells, however, bubbling over with zeal and enthusiasm to demonstrate his discovery, begged permission from Dr. John C. Warren to give a lecture and demonstration before the class in surgery at the Harvard Medical School. In his overenthusiasm and excitement he gave the boy having a tooth extracted insufficient gas thus causing him to scream out. Notwithstanding the fact that he admitted no pain afterward the experiment was considered a failure, discrediting the gas and ruining the discoverer; later, almost killing another patient in Hartford from an overdose, Wells lost confidence in both the gas and himself and gave up the practice of dentistry entirely. Disappointed, disheartened and in despair he committed suicide within a few years. Sometime after his death, for the benefit of his family, some tried to plead for him as the discoverer of anesthesia; however, in spite of the arguments in Toucey's pamphlet[7] and in Truman Smith's book,[8] which were largely instrumental in keeping Congress from granting Morton the $100,000 for the discovery, the best that can be conceded to Wells, as to Long, is that although he appreciated the practical application in surgery of what he saw at the "ether frolics," he did not carry the experiments to a decisive conclusion—insensibility to pain in surgery with safety and certainty. Strangely enough many years later Wells was acclaimed as the discoverer of anesthesia, for in an article on obstetrics and gynecology, T. Gaillord Thomas[9] wrote, "The year of 1846 was marked by a discovery in this country which may overshadow any other of its contributions to medicine. I allude to Anaesthesia discovered by Horace Wells a dentist of Connecticut, and subsequently made practicable and useful by W. T. G. Morton likewise a dentist of Boston."

Thomas E. Keys[22] states concisely probably the attitude of today: "Although Wells had failed to convince the world of the value of nitrous oxide as an anaesthetic agent, he is credited with conceiving the idea of anaesthesia and publicizing the possibility of its use." The stage was now set for the production of the long sought for extravaganza, "The Conquering of Pain." It was the golden opportunity for the right person to produce it and become the great hero in the age-long struggle to triumph over pain.

Everywhere vague attempts at its production were being made with what avail yet to be seen. Suddenly a faint ray of hope to the world dawned on the horizon; the first notice of anesthesia in any medical publication appeared[10] in *The Boston Medical and Surgical Journal* of Wednesday, October 21, 1846, under Medical Miscellany, a sort of medical catchall column which probably passed unnoticed by many. It said, "Strange stories are related in the papers of a wonderful preparation in this city by administering which a patient is affected just long enough to undergo a surgical operation without pain." The following week correspondence from Dr. E. R. Smilie,[11] appeared in the journal: "Sir:—As it is frequently found desirable to produce insensibility in persons requiring painful operations, I have made use of the ethereal solution of ether for that purpose with excellent results." Surely this is not what was referred to by the "strange stories." No, these "strange stories" were concerning the actions of a young individual with "stick-to-itiveness and go-aheaditiveness" as described by Horace Wells, named William G. T. Morton, and a "secret preparation" which he had for some time been experimenting with on animals and himself.

In spite of Wells' failure Morton was sufficiently impressed to buy several books containing information on the inhalation of ether long after Wells had given up the idea. Satisfied with its success and safety, when the opportunity presented itself on September 30, 1846, he seized it zealously. He saturated a folded cloth with ether, held it over the mouth of a strong, rugged fellow named Eben Frost until he was unconscious and painlessly extracted a firmly rooted, previously painful bicuspid. The great idea had come to pass; the discovery was achieved in less time than it had taken to tell it. The initial public notice of this important event appeared in the news of the *Boston Daily Journal*, October 1, 1846: "Last evening as we were informed by a gentleman who witnessed the operation, an ulcerated tooth was extracted from the mouth of an individual without giving him the slightest pain. He was put into a kind of sleep by inhaling a preparation the effects of which lasted about ¾ of a minute, just long enough to extract the tooth."

Naturally, to bring the complete ray of hope to suffering humanity required its use on a more formidable and impressive operation than a tooth extraction and before numerous spectators. Therefore, at possibly Dr. Charles Jackson's suggestion, Morton asked Dr. John Warren for such an opportunity in a letter of October 5th and received the following reply on October 14th: "Dear Sir: I write at the request of Dr. J. C. Warren to invite you to be present on Friday morning at 10 o'clock, to administer to a patient then to be operated on, the preparation which you have invented to diminish the sensibility of pain." (Signed: C. F. Heywood, House Surgeon to the M.G.H.)

Finally that great and exciting moment, 10 o'clock, October 16, 1846, arrived at the operating amphitheater of the Bulfinch Building of the Massachusetts General Hospital, but Morton could not be found. After waiting ten or fifteen minutes Dr. John Warren rather sternly remarked, "As Dr. Morton has not arrived I presume he is otherwise engaged." All laughed but it was no laughing matter, for just as he was about to make his incision to remove a tumor of the jaw, Morton rushed breathlessly in accompanied by a bit of moral support in the form of Eben Frost. With them they had a new inhalor only partially finished by the instrument maker, Mr. N. B. Chamberlain, only a moment before. Dr. Warren said, "Your patient is ready," whereupon Morton prepared his secret mixture (ether to which perfume, Eau de Mille Fleurs, the oil of Neroli, etc., for disguise were added) and proceeded to administer his compound. "Are you afraid?" he said to the young man, Gilbert Abbott, whom he had seen now for the first time. "No," the patient replied, "I feel confident and will do precisely as you tell me." For further assurance Morton pointed to Mr. Frost saying, "There is a man who has breathed it and who can testify to its success."

As exhilaration drifted into insensibility and unconsciousness, a sudden anxious silence enveloped the incredulous spectators (as only those in the operating room can experience) and was broken only by the calm but deliberate words of Morton, "Your patient is ready." From this moment on what transpired in that famous room has been vividly told by Dr. Warren himself,[12] in part: "On October 16, the patient being prepared for the operation, the apparatus was applied to his mouth by Dr. Morton for about three minutes, at the end of which time he sank into a state of insensibility, I immediately made an incision about three inches long through the skin of the neck and began a dissection among important nerves and blood vessels without any expression of pain on the part of the patient. Soon after he began to speak incoherently and appeared to be in an agitated state during the remainder of the operation. Being asked immediately afterwards whether he had suffered very much he said he had felt as if his neck had been scratched; but subsequently, when inquired of by me, his statement was that he did not experience pain at the time, although aware that the operation was proceeding.

"The effect of the gaseous inhalation in neutralizing the sentient faculty was made perfectly distinct to my mind by this experiment, although the patient during a part of its prosecution exhibited appearances indicative of suffering. Dr. Morton had apprised me, that the influence of his application would last but a few minutes after its intermission, and as the operation was necessarily protracted I was not disappointed that its success was only partial. . . . As was stated in the Hospital Records, apparently during this latter part of the operation the patient was conscious enough to move his limbs, and to utter extraordinary expressions; and these movements seemed to indicate

the existence of pain, but after he had recovered his faculties, he said he had experienced none, but only a sensation like that of scraping the part with a blunt instrument."

Obviously, as Dr. J. C. Warren[4] later wrote, this first operation should be placed in the class of cases of imperfect etherization. Nonetheless, it was sufficiently successful and more impressive and convincing than Wells' trial to him (Dr. Warren) to cause him to turn to the spectators and slowly but emphatically say, "Gentlemen, this is no humbug." Amid the discussion that prevailed among the physicians leaving the hospital Dr. H. J. Bigelow exclaimed, "I have seen something today which will go around the world." Thus October 16, 1846, became ever memorable and glorious to surgeons and suffering humanity as long as man shall exist.

Recognizing the need for further trial and evidence to prove conclusively the efficacy of this preparation, Dr. Morton was invited to administer it again the following day while Dr. George Hayward removed a large fatty tumor from a woman's shoulder. Dr. Morton administered his preparation, this time so satisfactorily that the potentialities of this new substance were convincingly shown. Many have since felt that this October 17th was the really conclusive day of discovery. Dr. Morton continued with added fervor and zeal his experiments and increased his successes while Dr. H. J. Bigelow, witnessing them, studied the physiology involved in the use of this old substance which created the new epoch or era of painless surgery. Although the use of the anesthetic was discontinued at the hospital until November 7th, Morton had in the meantime accumulated over 160 dental operations to his credit in his ever expanding private practice. During this period through a case of Dr. John Dix, early fortunately, the great danger of overetherization was discovered. It was pointed out by Dr. Bigelow that in etherization the pulse stands as a beacon between safety and danger, between harmless inebriation and fatal narcotism. Here was the salient feature in the safe use of ether. Dr. Bigelow, thus convinced of the efficacy of ether, read an abstract of his later famous paper at a meeting of the American Academy of Arts and Sciences on November 3rd. Dr. Bigelow, realizing the greatness of the discovery, played a large part in getting it substantially demonstrated before the surgeons. He felt the need of demonstrating its true worth in a major or capital operation, so on November 6th, at his instigation, Dr. Morton called at Dr. George Hayward's house to obtain permission to administer the new agent for an amputation he was to perform the following day. In his article Hayward[13] stated, "On the first of November I took charge of the surgical department of the hospital, and on the following day in conversation with Dr. Warren, I stated that I did not intend to allow the surgical patients to inhale this preparation of Dr. Morton's (for we were then ignorant of the precise nature of it) during my period of service, unless all the surgeons of the Hospital were told what it was and were satisfied of the safety of using it. Dr. Warren agreed with me as to the propriety of this course.

"On the 6th of November, Dr. Morton called at my house, and asked me if I was willing to have his preparation inhaled by a patient, whose limb I was to amputate on the following day. I told him of the conversation I had had with Dr. Warren on the subject. Dr. Morton at once said that he was ready to let us know what the article was and to give to the surgeons of the Hospital the right to use it here when they pleased. He added that he would send me a letter in the course of the day to this effect. I requested him to address it to Dr. Warren, as he was the senior surgeon, and told him I would submit it to my colleagues at a consultation to be held on the following morning."

He wrote the letter accordingly but Dr. Hayward after an interview with Dr. Warren notified Dr. Morton that ether would not be administered and that he need not attend the operation. Knowing the obstructive circumstances, Dr. Bigelow became all the more determined to do everything in his power to induce the hospital surgeons to use ether in this, the first decisive, final test as far as he was concerned. Afterward, writing about the events on November 7th, he said, "I called for him (Morton) in my chaise and took him with his inhalor to the Hospital. Leaving him in the small room adjoining the apothecary's shop, I sought an interview with the surgeons, all of whom were present, assembled in the operating theatre, and found them decided not to use the ether, their objections being something

connected with the professional etiquette of this community. Such objections lay, at that time against both the patent right connected with ether and the concealment, in part, of its character. I then went downstairs and prepared Morton for his impending disappointment. In returning to the amphitheatre I reopened the subject. Conversing chiefly with Dr. Hayward I said that a certain éclat would attend the successful event of the first amputation, which was by right due the Hospital; and, among other things, that this was not a question of etiquette, but of humanity. In reply to the objection that the new agent was still a secret I reminded Dr. Warren that I believe Dr. Morton had addressed him a letter, disclosing in form that the agent was sulfuric ether. Dr. Warren then took from his pocket a letter, which, if I remember aright, he read in part to the class and those standing near. This letter was then made the turning point in their decision! Dr. Warren having admitted its engagements had been complied with by Dr. Morton; and the surgeons immediately interested in the patient now agreed that ether should be administered to her." After a delay of half an hour or so, while this debate took place, Morton (who had remained at the hospital incognito except to Dr. Bigelow) was presented and by means of a defective and clumsy instrument administered the ether in such a way that in little more than three minutes the patient, Alice Mahan, was brought under its influence. The amputation took one and three-quarter minutes (exclusive of time required for tying ligatures) and obviously favorably impressed the entire amphitheater, which was filled to overflowing, to such an extent that all generally conceded that this major operation was the first decisive demonstration of sufficient caliber to convince the scientific minded of the real magnitude and true significance of this invaluable discovery. Certainly, as far as Dr. Bigelow was concerned, here now was the very evidence that was so essential for the proper perspective and evaluation of just what it was all going to mean to the future of surgery and human suffering, evidence necessary to him in order to deliver sincerely and convincingly his paper on November 9th before the Boston Society for Medical Improvement.[14] It was what one might call "the shot heard round the world." It began with very simple language to say the least: "It has long been an important problem in medical science to devise some method of mitigating the pain of surgical operations. *An efficient agent for this purpose has at length been discovered.*" Needless to say, undoubtedly, those living now can hardly realize or appreciate the thrilling impact of these words on all who heard or read them. In the same issue of the journal an editorial worthy of note was carried entitled "Operations without Pain": "In the leading article of this day's Journal, by Dr. H. J. Bigelow, the profession will notice that an impression exists here in Boston, that a remarkable discovery has been made. Unlike the farce and trickery of mesmerism, this is based on scientific principles, and is solely in the hands of gentlemen of high professional attainments who make no secret of the matter or manner to prevent it from being abused and falling into the power of low, evil minded irresponsible persons. We are informed that the discoverer has secured a patent, and that means were taken to have the same security in Europe even before publicity was given to it here. Without further remarks, we cheerfully publish all that has been given us on the subject, and wait with impatience for the decision of the profession in regard to its real value."

Little did the editors realize at this moment how extensive the writings on the subject would be as the profession from this moment shuffled around and began to take sides in one of the great controversies of all times, at first concerning the right and justification for any patenting of this discovery. J. F. Flagg quickly responded in no uncertain terms against such a patent on November 23rd.[15] "It would seem to me like patent sunlight or patent moonshine." However, while the pot of controversy boiled, medical journals all over the country and later over the world were publishing reports of the trials and successes of this new agent. The first account of private surgery under anesthesia to be published came from A. L. Peirson.[16]

Notwithstanding the enormous amount of favorable literature on the subject at this time it is most interesting to learn, although difficult to understand, of the attitude of our Philadelphia confreres as quoted from the *Philadelphia Medical Examiner* edited by Prof. Huston, in part: "We are persuaded that the surgeons of Philadelphia will not be seduced from the high professional path of duty, into

the quagmire of quackery by this will-o'-the-wisp; and if any of our respectable dentists should be tempted to try this new 'patent medicine,' we advise them to consider how great must be the influence of an agent over the nervous system, to render a person unconscious of pain, the danger there must necessarily be from such overpowering medication, and if a fatal result should happen to one of their patients, what would be the effect upon their conscience, their reputation and business, and how the practice would be likely to be viewed by a Philadelphia court and jury?

"We cannot close these remarks without again expressing our deep mortification and regret that the eminent men, who have so long adorned the profession in Boston, should have consented for a moment to set so bad an example to their younger brethren as we conceive them to have done in this instance. If such things are to be sanctioned by the profession, there is little need of reform conventions, or any other efforts to elevate the professional character—physicians and quacks will soon constitute one fraternity." "Mesmerism," a communication from Dr. Frans Dana, Jr.,[17] objected strenuously to Dr. Bigelow's attack upon mesmerism, "a subject which has been tested much longer than the inhalation of sulphuric ether for producing insensibility during operation . . . There are in this city, members of the Massachusetts Medical Society who are well aware of the reality of mesmerism, and are sufficiently independent to avow their belief, men who occupy an honorable rank in the society; and would not countenance farce or trickery."

Nevertheless, with but few exceptions, the news of the great discovery and the continued success in its use was accepted with universal acclaim and enthusiasm even though the name of the substance involved remained essentially a secret, except when it was declared on October 27, 1846, on the patent by Morton and Jackson. Of course Morton had announced the agent as rectified sulfuric ether to the surgeons at the Massachusetts General Hospital before the amputation operation on November 7th, but he still felt he wanted a specific name for it. On November 20th, therefore, he met at Dr. Gould's home with Dr. Bigelow and Dr. O. W. Holmes for this purpose. Of the whole list mentioned letheon is the name (derived from the Greek lethe, meaning oblivion) of one of the rivers of hell, of which the souls of the dead were supposed to drink to induce forgetfulness of the past. This was the name which struck his fancy and he exclaimed, "That is the name the discovery shall be christened." However, Holmes had other ideas and wrote to Morton the next day, November 21, 1846, as follows:

"My Dear Sir: Everybody wants to have a hand in a great discovery. All I will do is to give you a hint or two, as to names, or the name, to be applied to the state produced and the agent.

"The state should, I think be called 'anaesthesia.' This signifies insensibility, more particularly (as used by Linnaeus and Cullen) to objects of touch. The adjective will be 'anaesthetic state.' The means employed would be properly called the 'anti-aesthetic agent.' Perhaps it might be allowable to say 'anaesthetic agent' but this admits of question. . . . I would have a name pretty soon, and consult some accomplished scholar such as President Everett, or Dr. Bigelow Sr., before fixing upon the terms which will be repeated by the tongues of every civilized race of mankind. You could mention these words which I suggest for their consideration; but there may be others more appropriate and agreeable."

Strangely enough this word was not new as Osler[18] pointed out. He stated he was told that the word was used "first in Plato (Timaeus) and is used by Dioscorides in the modern sense. Again Miller[19] stated it was used in 1718 by J. B. Quistorpius in the title "De Anaesthesia." It first appeared in English in N. Bailey's Dictionary in 1721 as "anaisthesia, a loss or defect of sense, as in such as have the palsy or are blasted."

Morton more or less disregarded this term, anaesthesia, in favor of letheon which he also chose as the name for his various circulars and pamphlets advertising the discovery. These were described by B. P. Poore in 1856 in Historical Materials for the Biography of W. T. G. Morton" and two years later by Nathan P. Rice.[20] Recently Dr. John Fulton[21] presented a very able discussion and listing of these various circulars, most of which were published in 1846 and 1847. Between November 26, 1846, and May, 1847, Morton had published five editions of this circular "Letheon," while during a period from March to July, 1847, Edward Warren,[23] his legal agent and representative in Paris and Washington, issued

five editions of a pamphlet, "Some Account of the Letheon," which was really a collection of letters and relevant excerpts from various journals in support of the ether patent. This patent had been taken out in the name of Drs. Morton and Charles W. T. Jackson, the latter included by virtue of Morton's appreciation of Jackson's suggestion to him to *try ether*, all of which, Morton too soon was to realize, was the gravest error he ever made. At first 500 dollars would amply repay Jackson the full compensation for this suggestion and moral support he gave Morton. However, as the discovery took on greater and greater significance in honor and recognition, Jackson's claims likewise grew in stature; first, a demand of 10 per cent on the patent rights and then a demand of 25 per cent which Morton by this time in exasperation flatly refused. Thus began one of the great controversies of all time.

It essentially profits none to reiterate the detail of such an ignoble controversy of many years. Morton's appeal to Congress began in 1845 with his desire of having his discovery adopted by the Army and Navy. Instead they appropriated it and subsequently everybody seized ether anesthesia regardless of patent. Further sales of licences hopeless, Morton applied to Congress for compensation. Suffice it to say that his claim for remuneration as the real discoverer of surgical insensibility had been considered in the reports of many Committees of Congress between 1849 and 1863. In view of protest from Dr. Jackson and representatives of Dr. Horace Wells, congressional partisanship and various complexities of the issue, out and out approval was untimely delayed so that recompense never was his even after memorializing the President of the U. S. A.

More than a year after the Ether Controversy began, on March 18, 1848, a very excellent dissertation appeared in *Littell's Living Age*[32] on the events of the discovery and controversy which obviously and generally favored the side of Dr. Morton. However, following the publication in 1847 of "Discovery by Charles T. Jackson, M.D., of the Applicability of Sulphuric Ether in Surgical Operations" by Martin Gay, M.D., and various testimonies disapproving the claims of Dr. Morton in "A Defence of Dr. Charles T. Jackson's Claims to the Discovery of Etherization" by Jackson's attorneys, Joseph L. Lord and Henry C. Lord,[33] *Littell's Living Age*[34] made an about face and rescinded its favor of Morton as being of sympathy rather than opinion. The editor further stated, "But this sympathy, expressed by a resident of Boston, and presumed to know the opinion of scientific men in this city upon the subject, may give abroad a weight to claims and assertions which is entirely undue, and we know that, in a matter of pecuniary importance, we were deceived by one of the affidavits, which upon our looking at it again in the light of experience, was susceptible of an opposite interpretation to that which we had given to it. We find ourselves (however disinclined to pronounce judgement upon the controverted point) under the necessity of saying that we have heard the opinion of persons on whom we rely that Dr. Jackson was the exclusive discoverer."

Lowell again played a small part in the Ether narrative, being mentioned in various affidavits in the course of the Ether Controversy. A. Blaisdell states in one affidavit, "I returned to and sold three or four rights in that City, but encountered the same objection on the part of the purchasers." (This objection refers, first, to the necessity of one having to have a license to use ether and, secondly, to the two names of Jackson and Morton on the patent). In others Silas T. Gladwin and Samuel Lawrence, dentists of Lowell, swore affidavits to the effect that Dr. Blaisdell had called on them to sell the rights to use letheon and also had told them that Dr. Charles Jackson had first discovered the idea that this vapor would produce insensibility to pain during surgery and Dr. Morton had merely bought Dr. Jackson's right to the discovery. Also, as an interesting and humorous item the following is quoted from the *Lowell Courier* of November 14, 1846, "Encouraging—We yesterday received a long advertisement from Dr. Morton, dentist, of Boston, which he wished to insert if we will consent to take our pay in dentistry. We are much obliged to the doctor, but we will inform him that our teeth are as yet very good. We can't put in his advertisement on the condition offered."

A report[35] was presented by Hon. Thomas O. Edward, M.D., on February 23, 1849, in such an analytic and conclusive fashion that according to Dr. William H. Dwinelle[36] all should be convinced of the merits as well as the motives of the two claimants involved. He congratulates ". . . Dr. Morton upon the fact that opinion is constantly becoming more and more strong in general, that to his efforts and labors the

world owes one of its choicest blessings. Though the honors already received by him have through Dr. Jackson's instrumentality, been turned into insults, and the compensation fairly his due from the government, has through the same instrumentality, been as yet withheld; we cannot doubt that his services will eventually obtain a fitting reward, and that they will command the lasting gratitude of the Country and of mankind." Furthermore, in commenting on Morton's gift of $1,000.00 from the Massachusetts General Hospital and the award to Jackson from the French Academy he has this to say: "It seems to us that the efforts of Dr. Jackson and his friends have signally failed. On the one hand the *Casket* is in our opinion something more than a 'snuff box by way of charity.' And on the other hand, *The Ribbon* is something less than unanimous decision of the French Institute after a full sifting of all evidence."

That rarity,[37] the *Supplement to the Boston Medical and Surgical Journal*, without mincing words stated that many misstatements, not to say falsehoods especially in this community, in regard to the controversy continued to be made, and the importance and significance of the subject would more than warrent presentation before the public at large the debate in the U. S. Senate of Saturday, August 28, 1852, so that they could better judge fairly and impartially the true value of this great medical discovery.

Despite this great raging controversy that long tried the patience of the public and the strong medical opposition to anesthesia, great acclaim for this new boon to humanity continued to pour in from all parts of the new and old world. Following close on Peirson's first account of private surgery under the "new gas" came Cox's[38] article expressing his enthusiasm for this new expedient to relieve human suffering. It demonstrated the part played by Dr. Horace Kimball,[39] an accomplished dentist, as the agent of the discoverer in the introduction of letheon in New York The latter in his article presented according to him one of the most striking instances of the beneficial effects of letheon. It also related that Dr. Valentine Mott in removing a cluster of glands from an axilla December 8, 1846, was among the first surgeons outside New England to test the insensibility produced by letheon. Similarly, Dr. Alexander E. Hosack used this vapor a short time later in an amputation of the thigh and the removal of a scirrhous testis. However, in spite of all its favorable accomplishments it remained rather objectionable and unpopular to some, as noted in the New York Correspondence in the January 20, 1847, number of the *Boston Medical and Surgical Journal*, because of the existence of unprofessional secrecy and a patent. Dr. Charles A. Lee in the *New York Journal of Medicine and the Collateral Sciences* in words as vehement and bitter as those of Dr. Collins' from Philadelphia states, "We are sorry to see many of our brethren at home and abroad stooping from the excellent positions they occupy in the profession to hold intercourse with, and become the abettors of quackery in any form. Such doings are certainly contrary to the ethics of the profession, and should not be tolerated for a moment in any one." Hence it is not too difficult to realize why the use of anesthesia spread through this country none too rapidly. The first operation under ether in New Orleans, a thigh amputation at the Charity Hospital, was not performed until February 25, 1847, and a finger amputation by Dr. William Gibson at Philadelphia until May, 1847. In general it may be said that Philadelphia, the key point in American medicine, rather envious of Boston's honorable position, remained aloof and indifferent to the discovery. Nonetheless news traveled to and through the continent like wildfire. Fisher[40] states that after some experiment on his own J. Jobert invited him to administer the ether to one of his patients with cancer of the lip at Hospital Saint Louis on December 15th. This was the first demonstration in Paris.[41] However, it was not too successful. Many of the leading surgeons (Velpeau, Roux etc.) were still very skeptical and believed that sulfuric ether should be better understood and more information available concerning it before it was generally employed. After much experimentation he was again invited, this time by Roux, to administer ether on January 22, 1848, at the Hospital Hotel Dieu. This time there was perfect success.

On the same day Dr. Louis Velpeau performed an operation at La Charité Hospital with equal success. With both these famous men so difficult to convince claiming its virtues and proclaiming it "a glorious conquest for humanity" ether became well established in Paris as a surgical anesthetic, to refute forever

Velpeau's words of a few years before that pain and the surgeon's knife were inseparable.

Things were not at a standstill in London either. News of the great discovery reached this metropolis by December 17th through the correspondence of Jacob Bigelow of November 28, 1846, to his personal friend, Dr. Francis Booth, who saw to it that the news was well broadcast to his many associates.

On December 19th a dentist friend extracted painlessly a molar tooth from a relative of Dr. Booth with such overwhelming success that Robert Liston on hearing of the results was willing to attempt on December 21, 1846, the first successful major operation in Europe, an amputation of a limb, at the University College Hospital in London. From this time on many of the leading surgeons expressed themselves strongly in its favor.

Hence not only at home but also abroad, especially, was there rejoicing—through France, England and all of Europe—just as Velpeau in France had acknowledged that even the most incredulous must now bow before the power of facts. "We have seen them with our own eyes and must believe what we have seen. It was left for the new world and the City of Boston to demonstrate something which has been believed forever impossible—to confront us with an accomplished fact," said Robert Liston in England. "Hurrah! Rejoice, Mesmerism and its professors have met with a heavy blow and great discouragement. An American dentist has used the inhalation of ether to destroy sensation in his operations and the plan has succeeded in the hands of Warren, Hayward and others in Boston. In six months no operation will be performed without this previous preparation."

"Rejoice!" said Sir James Clarke, the royal surgeon. "It is really a marvelous thing."

The London Lancet reverberating the fervor and enthusiasm of all London wrote, "The discovery of Dr. Morton—more striking to the general than to the scientific mind—will undoubtedly be placed high in the blessings of human knowledge and discovery.

"That its discovery is a high honor to our transatlantic brethren; next to the discovery of Franklin, it is the second and greatest contribution of the New World to science, and it is the first great addition to the medical art. Dr. Morton deserves, if his discovery stands the test of time, the gratitude and reward of every civilized people and government upon the face of the earth."

Of all the tributes and testimonials none were in such glowing and elequent terms as those that appeared in the *Peoples London Journal* of January 9, 1847, under the title, "Good News from America." "Hail, happy hour! that brings the glad tidings of another glorious victory. Oh, what delight for every feeling heart to find the new year ushered in with the announcement of this noble discovery of the power to still the sense of pain, and veil the eye and memory from all the horrors of an operation. We have conquered Pain. This is indeed a glorious victory of pure intellect. And from America comes the happy news from one's brothers in another land. It is the victory of knowledge over ignorance, of good over evil; there is no alloy: all our finer sympathies are enlisted in one universal prayer of grateful rejoicing. Benevolence has its triumph. It is a victory not for a day, nor for our own time, but for another age, and all time; not for one nation, but for all nations, for generation to generation, as long as the world shall last.

"The rejoicing here is of the heart in the smile, the tear of joy for suffering relieved, the still voice of the benevolent some rejoicing inwardly; for to those who can grasp the full sense of the immense boon which has been given to us, it is indeed over powering—the blessing too incalculable. Let the joyous news spread quickly from ear to ear throughout all the length and breadth of the land, and wing its way over the seas from shore to shore."

With excitement and zeal the news of this great boon to suffering humanity did spread the length and breadth of the land. In Germany, also, it was fervently acclaimed. One of the country's famous surgeons, Dieppenback, wrote, "Pain, our intensest consciousness, our keenest assurance of the imperfections of the human body, had had to retreat before the power of man's mind, before the advance of ether vapor, this discovery has gone far to rob death of its terrors, for we dread death itself. Does not our imagination lead us to fear the agony of a major surgical operation more than we fear death so that we would do our utmost to avoid it? Now we can avoid this agony, to our wonder and admiration."

In Austria Josef Weyer exclaimed, "This is the most important and greatest discovery of our century. . . . What will be gained by the

prevention of pain in surgical operations can only be understood by those who have had to watch operations performed without anaesthesia."

Even in far off Russia we hear the similar echoes: "the greatest blessings, a gift from heaven, one for which we owe the utmost gratitude to the discoverer."

These are but a few of the praiseworthy declarations of the gratitude from the four corners of the earth to the discoverer of ether as a safe anesthesia. It is surely a happy hour, an eternal moment for universal thanks, as real and purposeful today as 100 years ago. This is especially so when it is realized that Dr. William Morton, disheartened, disappointed and in despair, died of cerebral hemorrhage on July 15, 1865, a pauper and an old man at the early age of forty-nine.

Thus is briefly chronicled the more than "twice told tale" of the beginning of painless surgery, a story that bears relating as long as man shall have the benefits of this greatest of all blessings, surgical anesthesia, with all its refinements and improvements over the past 100 years including the new character and caliber of surgery that has developed as its by-product.

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Case Reports

PERFORATION OF COLON IN THE NEWBORN INFANT*

RECOVERY FOLLOWING OPERATION

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PERFORATION of the colon in the newborn is relatively rare and is associated with a high mortality. Several examples of this disorder have been recorded in the literature but the only survival thus far following definitive surgery was the one reported by Lee and MacMillan.[12] The case herein recorded was not associated with a congenital anomaly of the colon as was present in the case of Lee and MacMillan. Furthermore, the cause of perforation of the rectosigmoid in this case was never established.

The subject of ruptured hollow viscus in the newborn has been comprehensively reviewed by many authors.[1,2,9,15,16] Therefore, it seems unnecessary to review the literature. It seems appropriate, however, to mention the possible etiologic factors of perforation of the colon and the diagnosis and surgical management of patients with this lesion.

The causes of perforation of the colon in the newborn may be varied. Not uncommonly the presence of such a lesion may escape detection with the resultant mortality mentioned heretofore. It seems highly probable that the incidence is greater than reported.

The etiologic factors of perforations of the colon may be conveniently divided into those associated with obstruction, proximal dilation and subsequent perforation of the dilated segment of the intestine and those with perforation without associated distal obstruction. Obstruction is usually secondary to a congenital anomaly. In some the obstruction is frequently the result of atresia. Stenosis not uncommonly produces incomplete obstruction but perforation proximal to such a lesion is relatively rare. Ladd and Gross[11] have not encountered perforation of the bowel secondary to stenosis. Reduplication of the colon is indeed rare, yet its resultant obstruction, although usually incomplete, could lead to proximal perforation. Summarily the most likely cause of perforation in the obstructed group would be atresia. Perforations of the colon secondary to an obstruction in some distal part of this organ frequently occur in the cecum which has distended to the extent that the blood supply has been compromised. Lee and MacMillan's[12] case is an excellent example of this pathogenesis. In the perforations at the site of a focal process many causes have been reported such as trauma, intestinal aplasia, primary vascular insufficiency, congenital or acquired diverticuli, peritoneal bands, adhesions and inflammation from one cause or another.

Trauma inflicted during delivery as an etiologic agent in the rupture of the large bowel has been suggested by Zillner,[18] Paltaul,[13] Titus[17] and Russell.[15] Zillner reported four cases of rupture of the sigmoid colon during delivery which he attributed to compression of the free loop of the sigmoid between the lumbar vertebrae and the anterior abdominal wall. Paltaul described spontaneous perforations of the colon and sigmoid in five newborn infants. These had all been spontaneous, easy deliveries. Titus stated that injuries of the intra-abdominal viscera could be caused by manual compression of the abdomen of the infant during breech extractions. However, in the nine previously mentioned cases all were vertex presentations. Russell in his review of thirty-nine cases of rupture of the bowel reported

* From the University Surgical Service, Kings County Hospital, and State University of New York College of Medicine at New York City.

twenty-eight cases including the aforementioned, which might have indirectly been related to obstetric trauma. He postulated that hydrostatic pressure transmitted by meconium could cause rupture of the bowel. All four of the infants in the series of Zillner had enemas which were given by unskilled midwives. It seems unlikely that a non-distended bowel only partially filled with meconium and containing no gas could be ruptured during passage of the infant through the birth canal. The possibility of rupture secondary to an improperly given enema or an improperly taken rectal temperature seems more feasible. Congenital defects in the bowel wall may be the fundamental factor of the perforations, especially the true and false diverticuli which have been carefully reviewed by Boikan,[4] Fischer[9] and Rudnew.[14] Abt[1] reported the presence of peritoneal bands and adhesions but concluded that they were probably secondary to the perforation. Bacterial invasion of the intestinal wall has been postulated as a cause of perforation but to date this has not been established as a primary factor. Finally, spontaneous rupture of the colon is not infrequent. Such perforations may occur anywhere from the cecum to the rectum and because of the inability to demonstrate either local or indirect causes may be classified as idiopathic.

The diagnosis of perforation of the large bowel in the neonatal period can be made if one considers the possibility of its presence. The clinical picture presented by the infant has been vividly described by Thelander[16] as follows: "An infant with perforation peritonitis present at birth or occurring soon after, presents a fairly classic picture. The little patient looks sick. He is cyanotic, the respirations are rapid and grunting, the abdomen is distended and the abdominal wall, the flanks and the scrotum or vulva are usually edematous. Frequently brown induration of the edematous area, which may resemble erysipilas, is also present. Food is taken poorly or not at all. Vomiting is frequent and persistent. The vomitus contains bile and may contain blood. The stools are either absent or scant. Some mucus or blood may be passed. The temperature may be sub-normal, but varying degrees of fever have been reported. The blood count is of little or no value. The hemoglobin content may be very high, which probably indicates only dehydration. The leucocytes may or may not respond with a rise. In cases of intra-uterine perforation the abdomen has at times been so distended at birth that delivery was impossible until paracenteses of the abdomen had been performed."

Roentgenologically, the diagnosis of perforated intra-abdominal viscus can be made by means of a scout film of the abdomen. Characteristically, there is massive pneumoperitoneum with or without associated hydroperitoneum. If the obstructed colon has not been decompressed by a rupture into the peritoneal cavity, its site may be demonstrated on the film. The administration of barium by mouth or by rectum in the presence of pneumoperitoneum is obviously contraindicated as is demonstrated by the case herein reported. Barium may escape into the free peritoneal cavity. The presence of free gas in the peritoneal cavity in a patient suspected of having perforation is sufficient evidence to warrant laparotomy. An attempt to establish a positive diagnosis by means of further x-ray studies in an already desperately ill patient is unwarranted. The surgeon, at laparotomy, should be able to discover the cause of the perforation and its site, and institute the proper surgical therapy.

CASE REPORT

A 7 pound 5 ounce female, normal vertex presentation, was delivered without instrumentation at 11:53 P.M. on March 21, 1950. The infant's general condition was excellent. The neonatal examination carried out the next morning revealed an apparently normal and healthy infant. One meconium stool had been passed. On March 23rd at 10:00 A.M. the patient vomited. The abdomen was markedly distended and tympanitic with mild erythema of the abdominal wall. Bowel sounds were absent on auscultation. The patient appeared listless and the cry was feeble. The temperature was 100°F. at this time. A small soapsuds enema was given with little or no return. The impression of the pediatrician was, "an obstruction secondary to some congenital anomaly of the intestinal tract."

Unfortunately a barium enema was given before a scout film of the abdomen had been taken. These films revealed massive hydropneumoperitoneum but no evidence of intrinsic disease of the colon. (Fig. 1.)

Examination at this time showed an acutely ill, listless, cyanotic, dyspneic, forty hour old infant with marked abdominal distention and

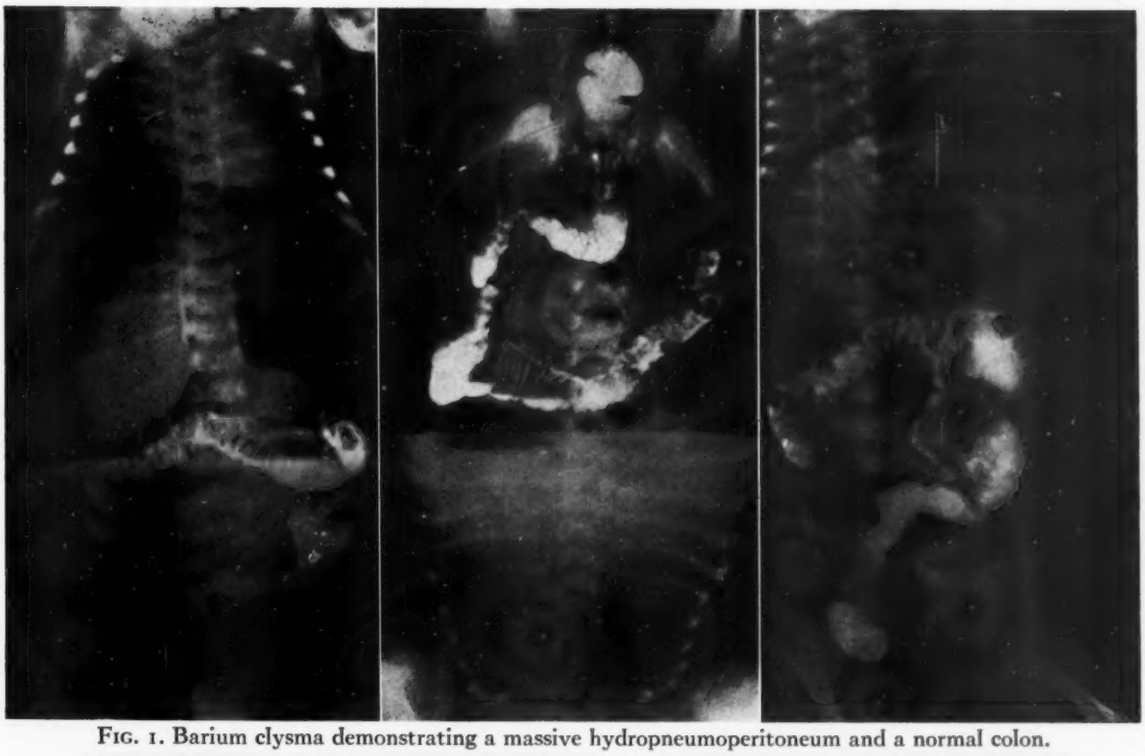

FIG. 1. Barium clysma demonstrating a massive hydropneumoperitoneum and a normal colon.

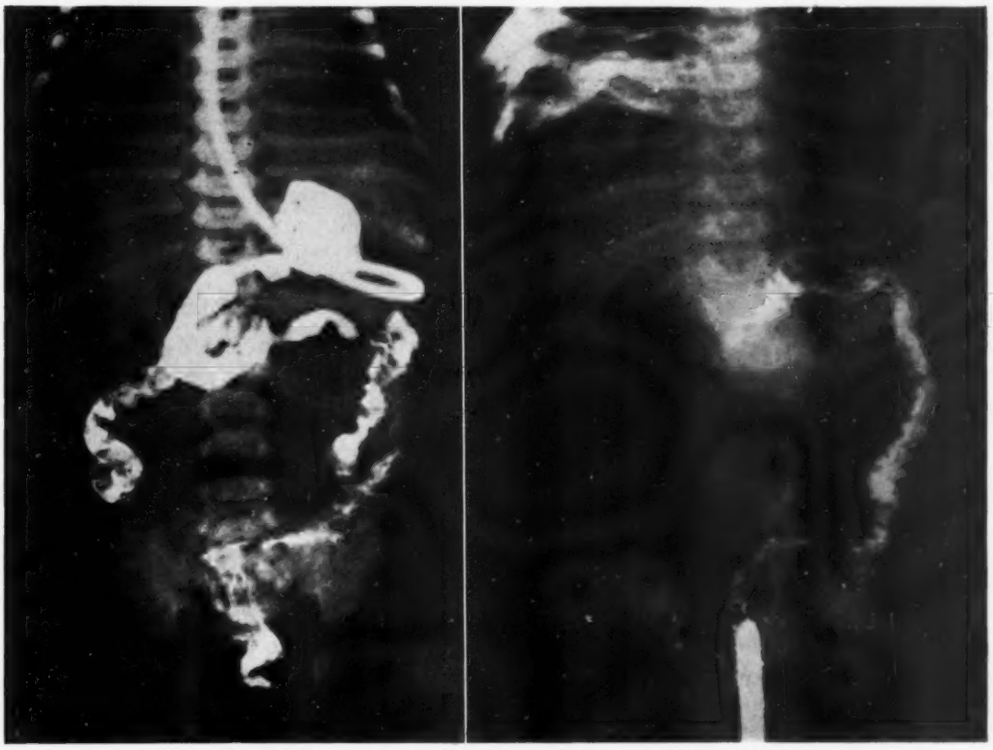

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FIG. 2. Gastric instillation of lipiodal. Extraluminal barium on the right side of the peritoneal cavity. The gas in the peritoneal cavity was removed during the paracentesis.

FIG. 3. Interval barium clysma showing the presence of an intact colon to the colostomy site and residual barium in the peritoneal cavity.

FIG. 4. Infant at ten months of age.

edema and erythema of the abdominal wall. The stump of the umbilical cord was normal. Rectal examination disclosed no abnormalities. Because of the marked dyspnea and cyanosis secondary to the tense pneumoperitoneum, a paracentesis was performed in the right subcostal region in hopes of relieving the respiratory distress. A large amount of odorless gas gushed forth and was followed with 20 cc. of cloudy yellow fluid which was alkaline in reaction and contained numerous pus cells. The infant's condition improved immediately. Palpation of the abdomen, which was now scaphoid, revealed no masses or collections. A catheter was passed into the stomach through which 5 cc. of lipiodal were instilled.

X-rays revealed no evidence of perforation of the stomach or duodenum; however, extraluminal barium was obvious and the impression was that perforation of the colon was present. (Fig. 2.) An immediate laparotomy was performed.

Under inhalation ether anesthesia forty-four hours after delivery the abdomen was entered through a right rectus muscle-splitting incision. Peritonitis and free barium were disclosed. Exploration revealed the colon to be normal except in the region of the rectosigmoid immediately over the peritoneal reflexion where barium continued to puddle after repeated aspirations. The barium presumably came from a perforation at this site which could not be visualized with certainty. Because of the precarious condition of the patient no further exploration was deemed advisable. A right transverse loop colostomy was performed and the wound closed in layers with interrupted silk sutures. Cultures of the fluid taken at the preoperative paracentesis and at laparotomy revealed Escherichia coli and lactobacillus.

The patient was placed in an oxygen tent and intragastric suction instituted. She was given parenteral fluids and penicillin, 300,000 units every three hours, and streptomycin, 25 gm. every six hours. On the first postoperative day the abdomen was soft. The colostomy was opened on the second postoperative day and functioned well by the third. On the fourth day after operation normal feedings were begun following which the patient's condition improved rapidly. There was progressive gain in weight for five weeks when marked dehydration secondary to diarrhea was present. Treatment was effective and the diarrhea subsided. Eight weeks postoperatively x-ray studies revealed the colon to be normal in appearance with no evidence of additional extravasation of barium. (Fig. 3.)

On September 16th intraperitoneal closure of the colostomy was performed. Three days later the infant passed a normal stool. She was discharged from the hospital in excellent condition on October 20th. (Fig. 4.)

COMMENT

When the diagnosis of pneumoperitoneum has been established roentgenologically, it is advisable not to administer barium either by mouth or by rectum in an attempt to demonstrate the site of perforation. The patient whose case is recorded herein was subjected to this diagnostic procedure and as a result barium escaped into the peritoneal cavity. Fortunately the infant survived despite this added insult. The presence of pneumoperitoneum is sufficient clinical evidence to justify surgical exploration. The surgeon under these conditions should make a very thorough search for possible obstruction.

In the presence of massive pneumoperitoneum with associated dyspnea and cyanosis, as demonstrated by the case being reported, it is advisable to perform an abdominal para-

centesis to release the intra-abdominal pressure thereby increasing the infant's vital capacity. This procedure was thought to be life-saving in this instance. It is well known that infants tolerate enterostomy poorly and that colostomy, although not associated with as high a mortality as enterostomy, is not infrequently followed with a critical postoperative course. However, this infant suffered no apparent ill effects. The colostomy effectively diverted the fecal stream from the unrepaired perforation of the rectosigmoid thus permitting spontaneous healing of the perforation. At a later date closure of the colostomy was performed.

CONCLUSIONS

Perforations of the colon in the newborn are undoubtedly more prevalant than reported. The attendant high mortality associated with this condition can be reduced by early diagnosis and proper surgical management. Perforations of the colon are due to some associated congenital anomaly with obstruction and proximal perforation, focal lesions of the colon and to unexplained causes. If massive pneumoperitoneum is present, an abdominal paracentesis should be performed prior to surgery to decrease respiratory distress. The diagnosis can usually be made by a scout film of the abdomen and in the presence of pneumoperitoneum barium should not be introduced either by mouth or rectum.

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OSTEOGENIC SARCOMA OF THE FINGER*

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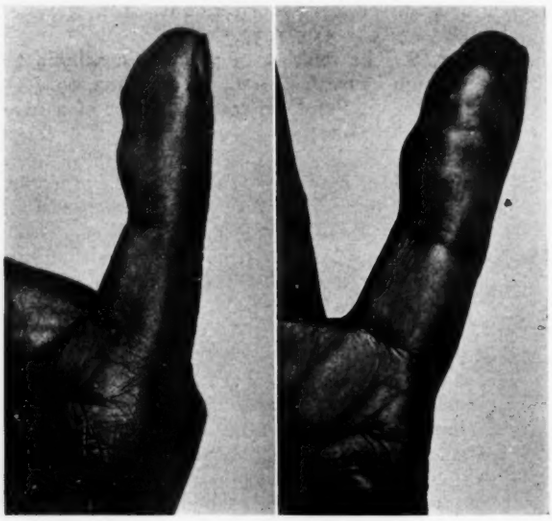
OSTEOGENIC sarcoma of the phalanges is an exceedingly rare tumor. Coley and Higinbotham[1] have reported one case involving the proximal phalanx of the fifth finger in a thirty year old male. An amputation through the fourth and fifth metacarpals was done and the patient has remained well for eleven years.[2] D'Antona[3] described a case affecting the thumb and Coley[4] collected from the literature one additional case of osteogenic sarcoma involving a phalanx of the hand and two of a toe.



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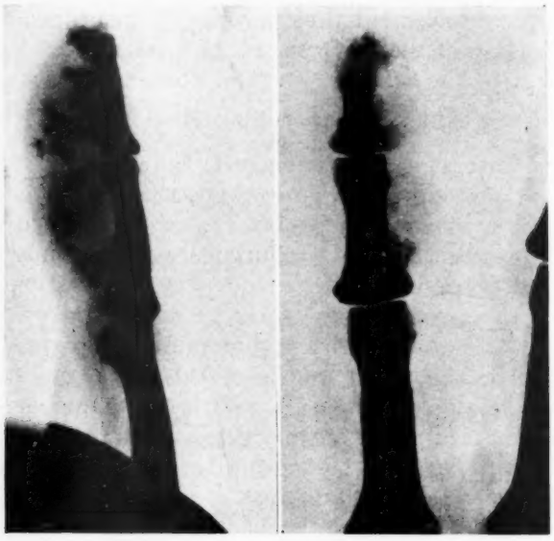
Photographs of finger.



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X-rays of involved finger.

Osteogenic sarcoma in this location is particularly interesting because of its rarity and because of the early detection of the tumor due to the small size of the part involved. The cure rate should be higher without an excessively mutilating operation than is possible with this type of neoplasm elsewhere. The following case, which is apparently the sixth such tumor recorded involving a phalanx, is reported for the above reasons:

CASE REPORT

E. M. (A133–558), a thirty-seven year old colored female, was first seen in the clinic of St. Luke's Hospital in June, 1947, complaining of tenderness and the sensation of a mass in the anterior surface of the distal end of her right index finger. A year previous to this on picking up a heavy bottle she had noticed an electric shock-like sensation shoot up her right arm. Thereafter on occasion she had noticed the same sensation usually associated with the use of her right index finger. Examination in the clinic showed no particular abnormality of the finger. X-ray revealed a fracture without displacement through the very tip of the terminal phalanx of the right index finger. She was referred to the fracture clinic but failed to keep this appointment.

She was next seen almost one year later in May, 1948, in the emergency room. She had noticed a gradual swelling and tenderness at the tip of her right index finger. Examination showed a circumscribed swelling approximately 1 cm. in diameter on the anterior surface of the distal phalanx of the finger. This felt cystic and an attempt to aspirate this tumor was made and nothing obtained. An x-ray taken the

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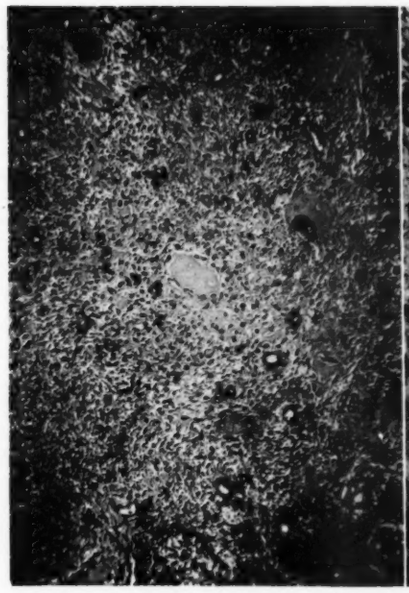

FIG. 5. Low power photomicrograph of tumor, × 120.

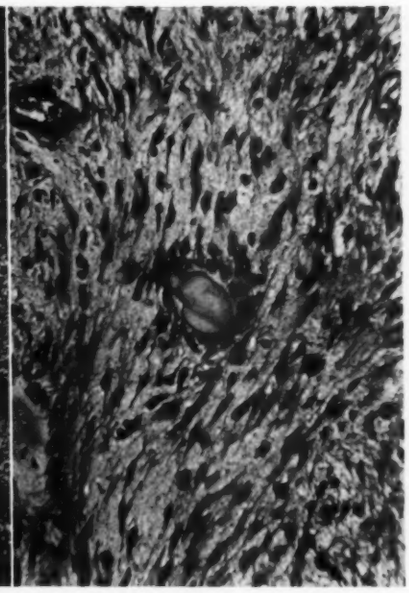

FIG. 6. High power view of tumor, × 400.

next day was reported as showing a large exostosis arising from the tip of the terminal phalanx and extending down into the soft tissues of the pulp. Admission to the hospital was advised but it was ten weeks later before the patient accepted. At this time the swelling extended proximally over the middle phalanx and was much larger. (Figs. 1 and 2.) The mass in the distal phalanx appeared lobulated. To different observers it appeared cystic, fluctuant and to transilluminate light. It was fixed to the underlying structures.

X-ray of the finger at this time revealed marked soft tissue swelling on the anterior aspect with rather marked irregular calcium deposits throughout this area of swelling. There was some destruction of the distal end of the terminal phalanx. No periosteal reaction was noted. (Figs. 3 and 4.) The radiograph of the chest was not remarkable save an enlargement of the cardiac shadow which had been noted also on a film fifteen months previously.

A biopsy was done with the following report: Section showed the skin which was relatively normal. Beneath this and extending throughout the remainder of the material was a tumor chiefly composed of fibroblasts but containing many spicules of bone widely scattered throughout. Some of these contained osteoid areas of newly formed bone with large osteoblasts in the periphery and near them were many other plump spindle-shaped fibroblasts, a few undergoing slight myxomatous degeneration but more of them showing characteristics of early bone formation. Other portions of the tumor contained bony spicules, some with no osteoblasts and many with only a few. It was doubtful whether any cartilage was present. The nuclei in the new bone-forming areas were larger than elsewhere and mitoses were fairly frequent. This tumor appeared to be a malignant one and it was one of the types of osteogenic sarcoma.[5] (Figs. 5 and 6.)

An amputation of this finger through the carpometacarpal joint was then done. The specimen contained a tumor measuring 1 by 1 by 3 cm. and arising from the tuft of the distal phalanx. It eroded the palmar surface of the terminal phalanx and entended as far proximal as the center of the middle phalanx. Microscopically, this tumor was identical to the biopsy specimen. The wound healed uneventfully and the patient remains well and apparently free of recurrence two and one-half years after operation.

COMMENTS

Due to its rarity osteogenic sarcoma is not often considered in the differential diagnosis of phalangeal tumors. This case illustrates the difficulty of diagnosis and particularly the misleading factors in the physical examination of

this region. Some observers believed that this tumor was cystic, fluctuant and transilluminated light. When excised, the lesion was not such that should have given these signs. No doubt the observers were misled in palpation but the apparent fluidity of the volar finger tip is due to the peculiar arrangement of the fibrous connective tissue largely perpendicular to the skin surface with the interspersed fat. This error resulted in attempted aspiration, which, inasmuch as neither fluid nor tissue for biopsy was obtained, contributed nothing constructive and introduced the danger of disseminating the tumor. The lesion appeared to grow faster after aspiration than previously. It is also interesting to speculate whether the fracture of the finger received almost a year prior to the onset of the neoplasm played any part in its development.

Due to the anatomic location of this tumor is was possible to amputate two joints above the lesion and still leave a useful hand. This is in contrast to the more usual locations of these neoplasms where amputation is often done through the same bone that is involved or the joint immediately proximal. In a tumor of the finger it would be difficult to justify the sacrifice of the hand or arm when evidence that this would increase the cure rate is lacking.

SUMMARY

A case of osteogenic sarcoma of the finger is presented and briefly discussed.

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METASTATIC CARCINOMA OF THE LUNG TO THE THUMB*

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METASTATIC carcinoma in the fingers is reportedly rare.[1,4,5] No mention is made in the latter references of carcinoma of the lung as a primary site of this type of lesion. Colsen and Willcox[2] have reported three cases of bronchogenic carcinoma with phalangeal metastases. It is well known that metastasis of carcinoma of the lung may be bizarre.[3] The following case is reported because of the rarity of metastasis of carcinoma of the lung to the terminal phalanges.

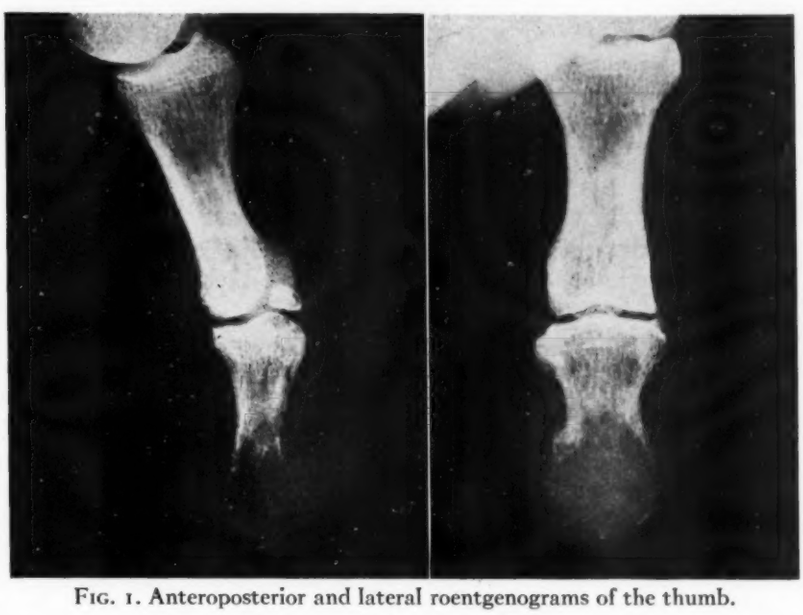

FIG. 1. Anteroposterior and lateral roentgenograms of the thumb.

CASE REPORT

This fifty-eight year old white male was admitted to the Veterans Administration Hospital of West Roxbury with history of a cough, pain across both shoulders and weight loss of 17 pounds in the preceding five months. During the month before admission he noted dyspnea on exertion, difficulty in swallowing solid foods and on three occasions blood streaking of his sputum.

Family history and past history were irrelevant.

Physical examination revealed a dyspneic, cyanotic white male who had obviously lost weight. There was distention of the neck veins. A hard 1 cm. movable lymph node was palpable just above the left clavicle. The chest was emphysematous. There was flatness to percussion and diminished breath sounds over the left anterior wall. The heart was shifted to the left but was otherwise normal. Blood pressure was 130/84.

The positive laboratory studies were as follows: Cytologic study of the sputum by Papanicolaou technic revealed cancer cells. Roentgenogram of the chest revealed atelectasis of the left upper lobe.

* Sponsored by the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are a result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

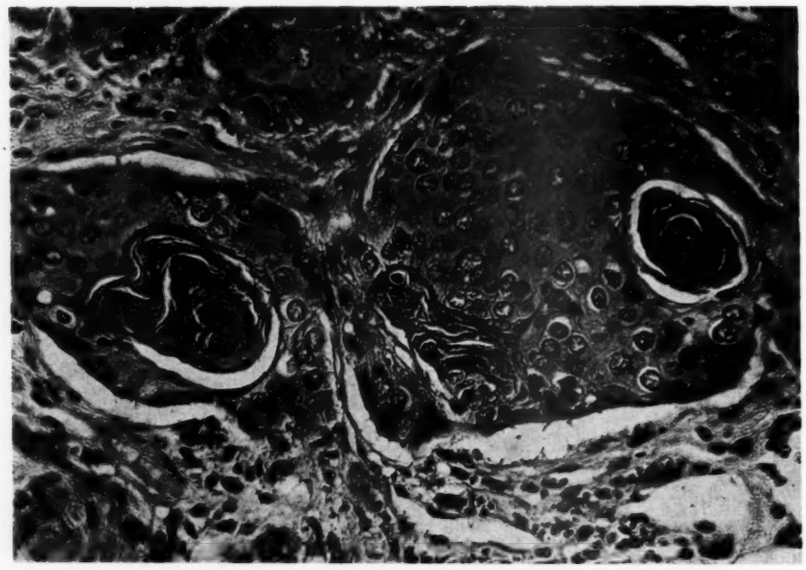

FIG. 2. Histologic section of the metastatic tumor to the thumb.

Biopsy of the left supraclavicular node revealed epidermoid carcinoma grade 3. The case was reviewed at Tumor Clinic and it was thought that the patient had incurable epidermoid carcinoma of the lung.

Four weeks after admission the patient complained for the first time of pain and swelling of the left thumb. He stated that he had incurred in the past many rose thorn wounds of the fingers while working as a gardener and that he might have sustained such an injury to his thumb recently. Examination revealed the distal phalanx of the thumb to be slightly swollen, tender to palpation and dusky red in color but with no local heat. Roentgenographic examination revealed a circumscribed osteolytic lesion of the distal phalanx of the thumb. (Fig. 1.) Both the diagnoses of chronic felon with osteomyelitis and metastasis to the thumb were entertained. Under local nerve block an incision was made over the distal end of the thumb. The pulp was replaced almost completely by a gristly grey soft tissue which on frozen section proved to be epidermoid carcinoma grade 2. Amputation of the thumb at the metacarpal-phalangeal joint was performed.

Pathologic examination revealed a firm, round, white lesion 1.5 cm. in diameter which completely replaced the distal phalanx and pulp of the thumb. The proximal phalanx appeared to be normal. Histologic examination revealed crowded masses of well differentiated tumor with frequent accumulations of cornified cells, scanty fibrous stroma and occasional osteoclast-like giant cells. (Fig. 2.) The diagnosis was metastatic epidermoid carcinoma grade 2.

Further x-rays of other bones were then taken and these revealed destructive lesions in the right frontal bone, right femur and left acromion.

Two months after admission the patient died. The pathologic diagnosis at postmortem examination was epidermoid carcinoma, grade 2 of the left upper lobe with metastases to the liver, head of the pancreas, left adrenal, right kidney, right frontal bone and left acromion.

SUMMARY

A case is presented in which epidermoid carcinoma of the lung metastasized to the distal phalanx of the thumb. Such an occurrence is of great rarity and emphasizes again the bizarre manner in which cancer of the lung may metastasize. Clinically, the lesion could not be differentiated from chronic felon.

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PROGYNON IN PROPYLENE GLYCOL—INTRAVENOUS ADMINISTRATION FOR INDUCTION OF LABOR*

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INDUCTION of labor in missed abortion or in a pregnancy with a dead fetus has never been easy. Evacuation of the products of conception has often necessitated operative interference. Any non-operative method of emptying the uterus is therefore of considerable value in treatment and is much safer to the patient, avoiding not only an operation but also the possibility of perforation of, or damage to, the uterus. This latter risk is a very definite one due to the extreme softness of the uterus carrying a "dead" pregnancy.

We have used estinyl for induction of labor in a large series of cases with considerable success,[1,2] both at term and in treatment of missed abortions. This method was by administration of estinyl orally, the dosage being rather high.

As early as 1941 we attempted to induce labor by administration of progynon in propylene glycol intravenously with success. Dosage has varied from 10,000 to 30,000 rat units each dose, given slowly in approximately two minutes' time in the cubital vein.

We are reporting two cases in which we have used intravenous progynon in propylene glycol to empty the uterus. The first case was that of a missed abortion of eleven months; in the second case the patient was a diabetic with a dead fetus at seven months. We have included a third case mistakenly diagnosed as a missed abortion; this case shows that very large amounts of estrogen will not produce excessive uterine bleeding, nor will they prevent the return of the first menstrual period at the usual time after termination of a pregnancy.

CASE REPORTS

CASE 1. Mrs. A. M., a twenty-one year old white female, gravida 1, para 0, registered in the Obstetric Outpatient Department in November, 1940. Her last normal menstrual period was in July, 1940. In March, 1941, it was discovered that the uterus was only the size of a fourteen to sixteen weeks' gestation and the patient was admitted to the hospital for observation. She had slight spotting which subsided with bed rest. Diagnosis at that time lay between missed abortion and normal pregnancy. The Friedman test was positive. It was decided to follow up the patient in the outpatient department. On May 7, 1941, the patient was readmitted to the hospital. The only bleeding since previous admission had been slight staining following pelvic examination in the clinic. The uterus had not increased in size and the Friedman test was negative. A diagnosis of missed abortion was established, but the patient signed out of the hospital. Vaginal hysterotomy had been advised.

The patient was readmitted June 4, 1941, complaining of fatigue and urinary frequency. Physical examination was essentially negative, the blood pressure was 106/70. Pelvic examination revealed a nulliparous introitus and no bleeding. The cervix was posterior, firm, closed, mobile and insensitive. The uterus was anterior, softened and irregularly enlarged to the size of a twelve weeks' gestation. Adnexa and cul-de-sac were negative. The diagnosis was missed abortion. The last menstrual period had occurred eleven months previously.

The patient received 30,000 rat units of progynon in propylene glycol intravenously twice daily for three days followed by minim doses of pituitrin. In the evening of the third day the patient had moderate vaginal bleeding and abdominal pains which subsided at midnight, June 7th. The patient expelled a complete uterine cast with placenta the following afternoon. There was minimal bleeding after the expulsion of the products of conception. The subsequent course was uneventful. The

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patient was discharged six days after expelling the missed abortion, following sensitization of the uterus with intravenous progynon in propylene glycol and induction of labor. The total dosage given was 180,000 rat units of progynon in propylene glycol intravenously.

Pathologic report showed placental tissue with hyalinization, necrosis and hydrapic degeneration.

CASE II. This patient, Mrs. F., a thirty-nine year old female, gravida XIII, para IX, was seen on June 6, 1950, at the Obstetric Outpatient Department Clinic, and admitted on June 8th. Expected date of confinement was August or September, 1950. The patient weighed 210 pounds. She stated that she had large babies, that the last three were stillborn and that for the past week she had felt no fetal life. The largest baby had been 11 pounds, stillborn. Urinalysis in the clinic was 4 plus for sugar. Blood sugar was 185 mg. One year before urine and blood sugar had been normal.

Menstruation was normal, having its onset at fourteen, the patient menstruated every twenty-eight days, with a three-day flow. Physical examination revealed the following: blood pressure 80/60, hemoglobin 12 gm. The uterus was the size of an eight months' gestation. No fetal heart was heard. X-ray showed a fetus seven to eight months in size, with cranial bones overlapping. A diagnosis of intrauterine fetal death due to diabetes mellitus was made. Insulin therapy was initiated with blood sugars of 192, 161 and 160 mg. Urea determination was normal; Mazzini test was negative.

Stilbestrol, 5 mg. three times a day, was given from June 10th to June 28th without effect. Repeated small doses of pituitrin were given intramuscularly with no effect on June 22nd. On June 27th 20,000 rat units of progynon in propylene glycol were administered intravenously at 12 A.M. and 4 P.M. On the following day the patient went into labor and expelled a 6 pound 9 ounce, dead fetus within a few hours. This baby would undoubtedly have weighed over 10 pounds had the patient gone to term. The postpartum course was uneventful and the patient was discharged on July 3, 1950.

CASE III. Mrs. V., a twenty-nine year old female, gravida IV, para 0, was admitted on July 18, 1950, because of vaginal bleeding and brownish vaginal discharge. The patient stated that her last menstrual period had been on March 10th. She had been hospitalized at another institution for one week because of vaginal bleeding. On June 20th she began to bleed again and this lasted until admission. Menstruation was normal, beginning when the patient was thirteen years old; she menstruated every twenty-eight days, with a three-day flow. The patient had suffered three miscarriages in the first trimester; dilatation and curettage had been performed two years before. There was a questionable history of tuberculosis. Blood pressure was 110/80; x-ray examination revealed old fibrotic subclavicular glands. On vaginal examination the uterus was the size of a ten weeks' gestation. The cervix was slightly patulous with a brownish vaginal discharge. A diagnosis of missed abortion was made. However, this was an error due to the fact that the patient spoke no English. It was learned later that the patient had expelled the fetus and probably placenta on June 5th at home prior to her first hospitalization.

Progynon in propylene glycol 30,000 rat units, was administered intravenously every four hours from July 18th to the 21st, with a total dosage of 360,000 rat units. There were no cramps or bleeding, only a slight brownish discharge. On July 30th the Aschheim-Zondek test was negative. The cervix was posterior and firm; the uterus was anterior, not enlarged and firm. The patient was discharged on July 30th. This patient had her first menstrual period following the miscarriage on September 22nd, just two months after the intravenous administration of progynon in propylene glycol. The period lasted five days with a normal flow and the patient's menses have been regular since.

CONCLUSIONS

1. Progynon in propylene glycol* has been given in two cases to induce labor and in a third case of mistakenly diagnosed missed abortion.

2. Estrogen helps to sensitize the uterus and can be used to initiate labor.

3. There were no untoward reactions of any kind.

4. There was no excessive bleeding fol-

* We wish to thank the Schering Corporation for furnishing the progynon in propylene glycol which made this study possible.

lowing use of progynon in propylene glycol intravenously.

5. Use of progynon in propylene glycol intravenously did not prevent occurrence of periods at normal interval.

6. We have used progynon in propylene glycol intravenously in other gynecologic conditions without any harmful or side effects whatever.

7. Further research with this type of therapy in obstetrics and gynecology is justified.

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True proliferative cysts of the pancreas should be excised since malignancy is always a possibility. Occasionally even partial pancreatectomy has to be performed. Pseudocysts are never malignant so marsupialization can be resorted to if excision is too difficult. However, these latter cysts can often be anastomosed to the posterior wall of the stomach. In these instances external loss of pancreatic enzymes is avoided and no skin excoriation occurs, as it often does after marsupialization. Besides, no persistent external draining sinus occurs. Of course, the internal communication between pseudocyst and stomach persists but this causes no symptoms and usually is not even demonstrable by gastrointestinal x-rays taken one or two years after cystogastrostomy. (*Richard A. Leonardo, M.D.*)

HYDATIDIFORM MOLE

PROGRESSION OF A CASE FROM THE BENIGN TO THE MALIGNANT STATE

ALEXANDER A. LEVI, M.D.

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HYDATIDIFORM mole is a curious aberration of pregnancy, occurring about once in every 2,000 deliveries. The course of this pathologic entity may be either benign or malignant. Cases have been reported in which benign moles have been passed or removed and later followed by full term deliveries. Death from a mole may result from postoperative sepsis, spontaneous perforation of the uterus, fatal hemorrhage following evacuation of the mole and, in the case of malignant mole, by extensive metastases through the circulation to the lungs unless diagnosed early and removed by hysterectomy.

Extensive histologic studies have been made by Hertig and Sheldon,[1] and Novak.[2] They emphasize the fact that the curettings obtained at operation are almost more important than the evacuated mole itself since these tissues give the clue which may demonstrate invasion or lack of it in the uterine wall. It seems, therefore, that the surgeon should carefully separate and label the tissues for proper evaluation by the pathologist. It must be remembered that the curet may not reach into the uterine wall at all, especially in patients curetted at a later date, and the curettings may not then be helpful.

The passage or evacuation of a benign mole is usually followed by normal uterine involution, no abnormal postpartum bleeding and within four weeks by negative Aschheim-Zondek tests. On the other hand, subinvolution out of proportion with the elapsed time, enlargement of the uterus, frequent episodes of staining or frank bleeding and Aschheim-Zondek tests found positive beyond the usual postpartum period of about four weeks, should draw attention to the probability of the presence of a malignant mole.

Hertig in his analysis of 200 cases uses such words as benign hydatidiform mole, followed in his classification by such terms as probably benign, possibly benign, possibly malignant, probably malignant and malignant. It would seem, in view of such a variation in terms, that the clinician might well consider a case of hydatidiform mole as malignant until he has exhausted all known methods in proving the tumor to be benign.

A case of malignant invasive mole (chorioadenoma destruens) is herewith presented as a cured case since the patient was alive and well two years after the event. This is the arbitrary time limit set by Hertig since most patients die within two years following the development of a malignant mole. This case is reported for the following reasons as well: The pattern was rather typical because of the development within the average time of thirty-five days post partum of subinvolution and bleeding. In addition large bilateral lutein cysts of the ovary were present. One ovary was removed because of partial torsion; the other regressed from the size of a kidney to normal limits within the period of about four months.

Sherman[3] in 1935 reported seventy-eight cases of hydatidiform mole. In three of these there were bilateral lutein cystic changes of the ovary. The ovaries were removed in these cases. Further study of the early literature shows that the nature of these cysts was not clear and that such ovaries almost invariably were removed. Later studies have clearly indicated that such a step need not be taken because the ovaries do return to normal. Novak writes "The exaggerated trophoblastic over-growth of the hydatidiform mole brings about an abnormal and excessive ovarian response" and "there can be little doubt that the spontaneous regression and disappearance of the ovarian lesion is the rule after removal of the hydatidiform mole or chorionepithelioma."

CASE REPORT

S. H., an eighteen year old female, was first seen in consultation by the author on December 10, 1947. She had been admitted to the Mount Auburn Hospital the day before because of slight vaginal bleeding. The entire past

history was uneventful aside from the usual childhood diseases. Menstrual periods began when the patient was thirteen, recurring at twenty-eight-day intervals. The last regular period occurred during the first week of September, 1947.

On December 5, 1947, some vaginal staining developed. This continued in small amounts for about ten hours. On December 9th there was more staining and bleeding. The patient was admitted to the hospital because her family physician considered the possibility of a miscarriage. He requested consultation the following day in view of the patient's marked restlessness and pulse rate of 140. Examination disclosed a symmetric mass presumed to be the uterus, filling the abdomen to such an extent that it compared favorably in size with an eight months' pregnancy. The mass felt unusually soft. Auscultation disclosed no sounds and no ballotment on palpation. It was impossible during rectal examination to feel the cervix because it seemed pulled up into the pelvis. The patient appeared acutely ill and in shock. The clinical evidence of intrauterine hemorrhage was quite certain. A diagnosis of hydatidiform mole was made. On x-ray examination lateral view of the abdomen showed a large, almost round but slightly lobulated soft tissue mass. It has no calcification. A large ovarian cyst could produce this appearance. The lobulation was rather unusual for a benign ovarian cyst. It was thought that this might be a malignant tumor of the ovary.

The patient was prepared for operation which was performed on December 10, 1947. Transfusions were given in view of the intrauterine hemorrhage. An abdominal incision was made in the midline, extending upward from the pubis beyond the umbilicus on the left. This incision was further enlarged in order to examine the abdominal contents.

Examination disclosed the uterus to be enlarged to the size of an eight months' pregnancy. It was soft and doughy. The left ovary was about the size and shape of a kidney due to the presence of numerous lutein cysts. There were numerous black areas throughout this entire ovary, particularly involving the areas between the cysts. The ovary appeared to be partially strangulated, the result of torsion. This ovary was removed. The right ovary was found to be even larger than the left due to cystic changes. A portion was resected. The bladder peritoneal reflection was then incised transversely and a small incision was made in the lower uterine segment. Numerous grape-like vesicles poured out of the uterine incision. More towels were then placed about the uterus. The incision was then lengthened upward to include the entire anterior surface of the uterus and the mole was entirely removed. Residual vesicles were "wiped off" with gauze from the walls of the uterine cavity and the uterine incision was closed in layers. The patient's immediate postoperative reaction was satisfactory.

The pathologic report was as follows: Curettings comprised placental tissue including the villi, decidua, little gravid endometrium and an abundance of older and recently coagulated blood clots. The villi were all large, edematous, coarse and avascular. Many of them had cystic centers. The smaller were represented by a central core of loose, myxomatous, avascular and relatively acellular, edematous stroma bordered by a single and sometimes double layer of cytotrophoblasts, some of which showed a brush-like or ciliated outer border. The bordering epithelial cells, for the most part, were flattened, multinucleated, syncytial cells, with here and there a second layer of small, cuboidal trophoblasts. Such villi were similar to those encountered in cases of uncomplicated "blighted ovum." The larger villi presented quite a different picture. There was the central core of loose, edematous stroma and this was bordered at the periphery by trophoblastic epithelium. The latter was very hyperplastic, forming large, thick fringes of closely compact cells. These cells included multinucleated syncytial cells and cytotrophoblasts. The multinucleated syncytial cells were riddled with small and large vacuoles, some empty and some containing a lightly staining basophilic precipitate. The cytotrophoblasts formed the bulk of the cellular material and showed great variation in shape and size. The nuclei, too, showed a wide range in size and shape. Many were heavily laden with chromatin, some had double and triple nuclei and almost all had one or more large, coarse nucleoli. Occasional mitoses were seen in both syncytial and cytotrophoblast cells. Some of the cytotrophoblasts had small vacuoles and some had clearly defined eosinophilic hyalin droplets in their cytoplasm. The stroma of the villi was condensed at the periphery, and edematous and cystic centrally. There was no trace of inflammatory

infiltration into the substance of any of the villi and none of the villi was vascularized or showed focci of embryonal erythropoiesis. The decidua was partly viable and partly necrotic. Many of the vessels showed fresh thrombosis, and many of the smaller vessels were partially or completely blocked by an ingrowth of cytotrophoblastic cells. In some areas of infarcted decidua the tissue was saturated with an inflammatory leukocytic infiltration.

The picture here, involving the curettings, was one of an actively proliferating hydatidiform mole, apparently arising on the basis of a pre-existing blighted ovum. The picture was complicated by thrombosis, hemorrhage and acute inflammation. There was insufficient evidence for a diagnosis of malignancy.

There was one intact ovary (left) and a portion of second ovary (right). Each was large, soft, edematous and riddled with large and small cystic follicles. The surface was smooth. The histologic examination showed a large corpus luteum of pregnancy. The cells of this were unusually large. Many were vacuolated and many showed hyalin droplet inclusions within the cytoplasm. Theca cells bordering the luteal cells were swollen, eosinophilic and showed abundant luteinization. All of the follicles seen grossly were bordered by layers of follicular and theca cells, the latter showing active luteinization. Some of the follicles had fresh hemorrhage into their lumina. Some of the follicles showed excessive luteinization of follicular epithelium, and one follicle with this had at its center a collapsed, somewhat crescentic ovum. The stroma cells throughout the ovary were for the most part larger than normal, and mitoses among these cells were quite common. In addition to the hyperplasia of the stroma, hyperplasia and luteinization of the theca cells and follicular epithelium there was a very interesting change in all of the arteries of both ovaries. This change was most marked in the immediate vicinity of the large corpus luteum of pregnancy. This change was characterized by swelling and active proliferation of endothelial cells, with a deposition of mucinous ground substance in intercellular spaces; the media of the vessel and, to a lesser extent, the adventitia were edematous, widened and rich in proliferating fibroblasts. The composite picture was one of obliterating proliferative arteritis.

The over-all picture here was that of a moderately well advanced hydatidiform mole arising within the uterus from a pre-existing blighted ovum. The changes in the ovaries, characterized by stroma cell proliferation, widespread theca cell formation and diffuse luteinization of follicles were those commonly associated with this type of disease of the placenta. (These ovarian changes normally regress after removal of the uterine contents.) The changes in the arteries in the ovaries were of particular interest and were probably related to the hormonal changes associated with ovarian activity. There was insufficient evidence in any of our sections for a diagnosis of malignancy.

The patient was discharged from the hospital on December 20, 1947. On January 22, 1948, she stated that she had had some vaginal bleeding two days earlier, not having had any since her discharge from the hospital. The abdominal wound was well healed. Vaginal examination disclosed the uterus to be somewhat enlarged.

On February 25th the patient stated that she had bled as follows: January 24th, February 6th, 7th and 8th, and profusely on February 11th for a half day. The uterus on this date was found to be two to three times larger than at the previous vaginal examination and was taken to be evidence of a developing malignant mole. In the meantime quantitative Aschheim-Zondek tests had been performed at weekly intervals. These tests were positive, at first in dilutions up to 15, and on March 17th the test was reported positive in 20 dilution. The laboratory on this date added the following note: "When there is a dilution of 20, chorioepithelioma should be suspicioned, since the uterus was emptied about three months ago." In view of these gross changes the patient was again hospitalized.

On March 19, 1948, at the Allerton Hospital a panhysterectomy and left salpingectomy were performed. Examination of the abdominal contents at this operation disclosed the uterus to be enlarged to nearly the size of a two and a half to three months' pregnancy. There were some glistening areas over the anterior surface, which appeared to be tissue-paper thin. Numerous enlarged veins were found over the anterior surface of the uterus and extending upward. The right ovary was found to be about one and a half times larger than normal and contained some deep yellow lutein cysts. The

left tube was found to be enlarged and bound down by adhesions. The adhesions were freed and the tube was removed. It was now possible for the first time to examine the uterus satisfactorily. It was so boggy and tense that one gained the impression that it would rupture even with slight pressure. The marked bogginess extended down to the level of the internal os and because of this finding a panhysterectomy was performed to prevent spilling of the uterine contents.

The pathologic report revealed the following: Microscopic examination of sections taken from the mass of tumor contained within the uterine fundus revealed a complicated pattern of pathologic changes. For the most part the tumor mass was composed of blood clot. This clot showed considerable breakdown of the red cells, with lamination of fibrin. Scattered diffusely throughout the clot conforming to no distinct pattern there were necrotic oval to round, plump cells apparently decidual in type. Similarly, scattered there were numerous cross sections of chorionic villi showing a loose, edematous stroma relatively devoid of vessels and covered by a thin layer of chorion epithelium. Most of these covered cells were of the syncytial type and entirely disposed in small clumps and singly about this villi. No sheets or masses of cells were found. The cells themselves had somewhat deeply chromatic nuclei but were not unusually large and no marked mitotic activity was found. In the junction of this contained tumor mass and myometrium there was a zone of shadowy, necrotic, decidua-like cells containing an active inflammatory reaction of polymorphonuclear leukocytes and macrophages. Throughout the underlying myometrial wall there was a similar acute and chronic interstitial inflammatory reaction most marked about the vessels. The serosa in these areas was lined with a fibrinosuppurative exudate. The vessel walls were the sites of a remarkable change. Within the walls extending into the lumen of the vessels numerous plump oval to round cells were found which had fairly regular round nuclei and an eosinophilic cytoplasm. These cells were mononuclear and apparently resembled decidual cells. No syncytial type giant cells were found in these areas. There was no evidence of extension of the chorionic epithelium into the myometrial wall or into the blood vessels. The diagnosis was invasive mole. (Fig. 1.)

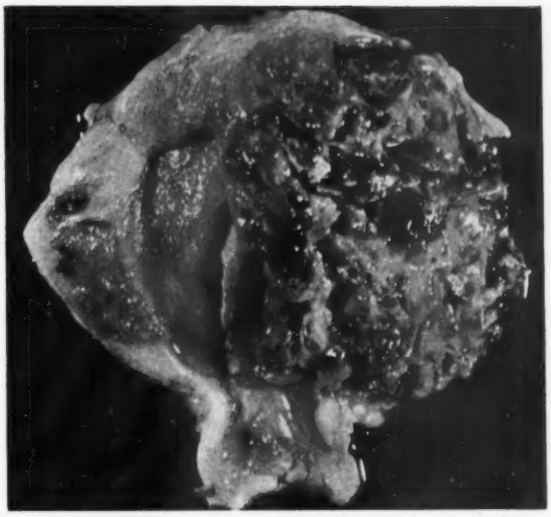

FIG. 1. Invasion of uterus by malignant hydatidiform mole; patient eighteen years old.

In a communication concerning this case Dr. Hertig stated, "It is a chorioadenoma destruens or invasive mole, albeit somewhat atypical. I base my conclusion on the following: (1) the presence of hydatids grossly; (2) the clinical evidence of invasion, bleeding and subinvolution with rising titre within the first two months; (3) the cavity formation within myometrium caused by relatively well differentiated trophoblast, much of which seems to be dying out; and finally (4) there is tumor in the uterus, which many (but not all) true choriocarcinomas fail to show. I think the prognosis should be guarded, even though much of the process seems to be dying out, because of the extensive nature of the process and its multifocal nature."

The patient was discharged from the hospital March 28, 1948. Quantitative Aschheim-Zondek tests were then performed at frequent intervals. The last positive one occurred on April 28, 1948, and the first negative one on May 12, 1948. In spite of negative tests further examinations were made throughout the remainder of the year, the last negative report being received on December 21, 1948. Vaginal examinations have been performed numerous times during the inverval since her discharge from the hospital. The remaining ovary on April 28, 1948, seemed to be normal in size. The patient was last examined on March 15, 1950, at which time no abnormalities were noted.

SUMMARY

The history, course and disposition of a case of hydatidiform mole occurring in an eighteen-year old gravida 1, para 0, is presented. The uterus was emptied by hysterotomy on December 10, 1947. Both ovaries were enlarged due to polycystic lutein changes. The smaller ovary, nearly the size of a kidney, was removed because of torsion of the pedicle causing it to appear almost black in color. Approximately thirty-five days later there was vaginal bleeding; examination disclosed definite subinvolution. During the next month there were frequent episodes of bleeding and the uterus continued to enlarge. Numerous Aschheim-Zondek tests continued positive in various dilutions. On March 19, 1948, a panhysterectomy was performed. The pathologist reported the tumor to be a malignant invasive mole (chorioadenoma destruens). The quantitative hormone tests were first reported negative on May 12, 1948, and continued so through December, 1948, when they were discontinued. The remaining ovary was found to be still enlarged at the second operation, March 19, 1948, but on palpation felt normal first on April 28, 1948, and last on March 15, 1950. The patient at present writing is well and therefore considered cured.

CONCLUSIONS

1. After the passage or evacuation of a hydatidiform mole the patient must be observed closely for bleeding, continued subinvolution or enlargement of the uterus occurring within the average time of thirty-five days. If these occur, a malignant mole must be suspected.

2. Quantitative Aschheim-Zondek tests must be performed frequently. If positive findings persist in great dilutions, a malignant mole must be considered.

3. Early operation, hysterectomy, must then be performed.

4. Statistical evidence discloses that a case of malignant mole may be considered cured if the patient is alive after two years have elapsed from the time of hysterectomy.

5. Multiple lutein cysts frequently cause marked enlargement of both ovaries in the presence of hydatidiform mole. These will regress after the uterus has been emptied in a benign case or after hysterectomy in a malignant case and should not be removed.

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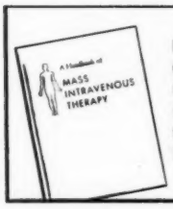

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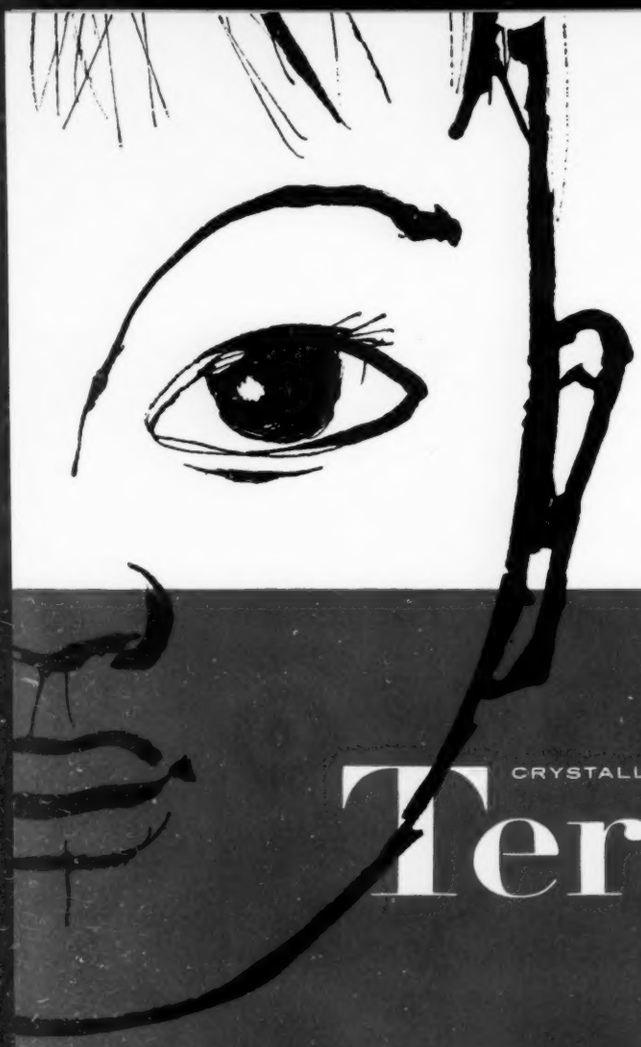
1. Bowers, W. F.: Chlorophyll in Wound Healing and Suppurative Disease, Am. J. Surg. *73*:37, 1947.

2. Niemiro, B. J.: Delayed Healing in Pilonidal Cyst Wounds, Journal Lancet, Sept. 1951.

RYSTAN COMPANY, INC. Mount Vernon, New York



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FOR the entire year of 1944 the American drug industry produced one trillion units of penicillin. Current production is estimated at 30 trillion units per month. In addition to being a potent weapon against venereal diseases, penicillin is widely used against pneumococci infections, hemolytic streptococci infections, minor staphylococci infections without bacteremia, and is a powerful prophylaxis in minor surgical and dental operations.

APPROPRIATIONS by The Rockefeller Foundation in 1950 totaled $11,247,964, President Chester I. Barnard says in a foreword to the Foundation's Annual Report. Total for grants in the five main fields of the Foundation's activities were: public health, $2,326,840; medical sciences, $1,240,900; natural sciences, $2,092,515; social sciences, $2,122,085; humanities, $1,491,250; in addition to miscellaneous, $477,500; scientific services, $1,003,747; and general, $493,127. Of the total made available for all divisions of work, 65 per cent was for activities in the United States and 35 per cent for activities in other countries. Commenting upon the reorganization under which the International Health Division was discontinued and the Division of Medicine and Public Health created to conduct the Foundation's program in the field of public health and the medical sciences, President Barnard observes that the new division is "designed to meet today's larger concept of medicine in which the formerly distinct boundaries between curative and preventive medicine are rapidly disappearing."

THERE'S uranium in them thar hills if you have a Geiger Counter. And at last you can select one over the counter. America's first atomic age department store opened this week in New York City and already the rush is on for "sniffers," "snoopers," "classmasters," "cutie-pies" and "ferrets," as varitype radioactivity detectors are called. Now the celebrated but difficult to obtain Geiger Counter can be purchased across the sales counter as easily as a wrist watch and about as cheaply. The first retail shop for prospective uranium prospectors—like the first location of the famous Manhattan Project which developed the atom bomb—is in New York City. Unlike the Manhattan Project its address is not secret but right on the world's busiest corner, 5th Avenue and 42nd Street. Started and staffed by several former atom bomb scientists, the Radiac Company exists to supply everyone—prospectors, medical doctors, laboratory technicians, civil defense workers, hobbyists and engineers with a variety of atomic instruments needed in their activities.

A COLD spray that stops excruciating pains of heart disease and hormonal substances which give promise of speeding up or slowing down blood-clotting are among medical subjects that will be studied under 238 research grants awarded by the Public Health Service, Federal Security Administrator Oscar R. Ewing announced. The grants which total $3,038,418 will go to eighty-eight medical schools, hospitals, research institutions and private individuals in thirty-two States, the District of Columbia and Puerto Rico in support of basic and clinical heart research.

SUCCESSFUL use of an artificial heart and lungs to tide over circulation of blood in patients undergoing critical heart and general chest surgery can be expected in the near future, possibly within a year, scientists attending a symposium on artificial heart-lung machines predict. The symposium was held at the National Institutes of Health, Public Health Service, Federal Security Agency. The prediction highlights a report on the symposium made by its chairman, Dr. Frederick A. Coller, Chief of the Department of Surgery at the University of Michigan, Ann Arbor.

"Most of our knotty technical problems have been solved," said Dr. John Gibbon, Chief of the Department of Surgery, Jefferson Medical College, Philadelphia, and dean of scientists working to perfect mechanical hearts. "We can expect that in the very near future a mechanical heart-lung apparatus will be ready for application on human patients."

SOME 12,300,000 Americans, one of every twelve in the entire population, have passed their sixty-fifth birthday. At the beginning of the 1900's the ratio was one of every twenty-five. Of those sixty-five or older a very large proportion, over 40 per cent, are in the sixty-

(continued on page 44)

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* Ref. Am. J. Surg., March, 1951.
J.A.M.A. April 21, 1951 p. 1238

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Outside the Ivory Tower

(*continued from page 42*)

five to sixty-nine age range. Although during these ages great numbers retire from active employment, many are still capable of productive effort and form a sizable reservoir of manpower if there should again be a critical labor shortage.

A NEW red blood cell counter which will allow greatly increased speed of mass blood counts has been developed by Cornell University under an Office of Naval Research contract. Using the new instrument, which relates the red cell count to the electrical conductivity of whole blood, three technicians can perform forty to sixty blood counts an hour by "production-line" methods, as compared to the present rate of about twelve to eighteen an hour. The counter was developed by Dr. I. S. Wright, Dr. Erwin Sheppard and Professor W. C. Ballard, Jr., of Cornell University, as part of a Naval Research study of the electrostatic forces in the blood and their relation to coagulation. Mass blood counts are vitally necessary under battle conditions in estimating damage due to hemorrhage, shock, flash burns and exposure to ionizing radiations. The new method will also be helpful in making routine hospital blood counts and in screening men for military service. Errors in the visual blood counting methods now used are avoided in the new instrument since there is no dilution of the blood and the quantity used is not critical.

JOHN E. McKeen, president of Chas. Pfizer & Co., Inc., has been named as Honorary Member of The American Institute of Chemists. Mr. McKeen was honored by the Institute "for his vigorous and unselfish efforts in the advancement of chemical manufacture to help and heal mankind." The citation, which has been made to only forty-six men during the Institute's twenty-eight-year history, was announced by Lawrence H. Flett, president of the AIC and director of the New Products Division, Allied Chemical & Dye Corporation. Mr. McKeen, who has been associated with Chas. Pfizer since 1926, took an active part in developing technics which first made possible the mass production of penicillin and later streptomycin. More recently he spurred the antibiotic research program at Pfizer which culminated in the discovery of the wide range antibiotic, terramycin.

THE progress which has been made in safeguarding maternity constitutes a significant chapter in the history of American public health. Today the hazards incidental to pregnancy and childbirth are at a level which seemed Utopian not many years ago. As recently as 1935 the maternal mortality rate in the United States was fifty-eight per 10,000 live births, the lowest recorded up to that time. Currently the rate is appreciably under ten per 10,000 nationally, and in large sections of the country it is even less than five per 10,000 live births.

AROUND and about us are a dozen or so new books or editions worthy of praise. All are outstanding or above average in their surgical field.

The department of orthopedic surgery is represented by four publications.

The second edition of "Surgical Treatment of the Motor-Skeletal System" comes to us from the J. B. Lippincott Co. The Supervising Editor is Frederic W. Bancroft, M.D. and the Associate Editor is Henry C. Marble, M.D. The work has been written by forty-six contributors some of whom are new to this edition. New subject matter and material have been added. Part One (really Volume 1) covers Deformities, Paralytic Disorders, Tendons, Bursae, New Growths, Diseases of Bones and Joints, and Amputations. In this volume there are 519 illustrations and one color plate. In Part Two are considered Fractures, Dislocations, Sprains, Muscle and Tendon Injuries, and Birth Injuries. There are 1,303 pages, 530 illustrations and two color plates. A Bibliography is at the end of each chapter and there is a bibliographic index as well as a subject index. $24.00.

"Instruments and Apparatus in Orthopaedic Surgery," by E. J. Nangle, M.D., with a Preface by H. J. Seddon and Joseph Trueta, is put out by Charles C Thomas. This excellent and interesting work presents orthopedic surgeons with considered advice on the choice of appliances. The design and manufacturers of appliances for various conditions are discussed and supplemented with a wealth of illustrations. There are a subject and author index. $9.50.

Recently published is the second volume of "Post-Graduate Lectures on Orthopedic Diagnosis and Indications" by Arthur Steindler,

(*continued on page 46*)

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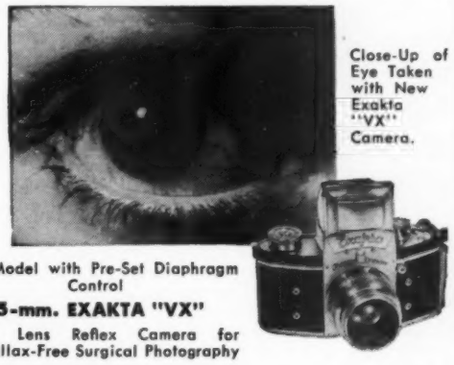

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Outside the Ivory Tower

(*continued from page 44*)

M.D. Section A covers Paralytic Disabilities; Section B, Static Disabilities. The book contains 208 pages, has 209 illustrations, a Bibliography and a subject index. It is put out by Charles C Thomas at the price of $6.00.

"Congenital Dislocations of the Hip," by Julius Hass, M.D., appraises the recent theories and methods of treatment and clarifies some of the pending problems in etiology and pathology (based on over 2,000 cases of congenital dislocation of the hip). The book is 198 pages in length, has 174 illustrations, a Bibliography of sixty-nine pages and a subject index. The publisher is Charles C Thomas and the price is $12.50.

"The Essentials of Modern Surgery," edited by R. M. Handfield-Jones, M.C., M.S. and Sir Arthur E. Porritt, M.A., M.Ch., is a fourth edition and has fourteen contributors. The book is 1,264 pages long, has 644 illustrations of which many are in color, and a good index. It is published by the Williams & Wilkins Co. $11.00.

"Surgical Practice of the Lahey Clinic" is written by members of the staff of Lahey Clinic, Boston. We can do no better than quote from parts of the Preface by Frank H. Lahey. "This volume is published almost exactly ten years after the first volume. It presents procedures which by frequent repetition have become quite standardized in this clinic. We would like to state that although we have frequently discussed and emphasized the value of standardizing methods, in presenting these methods and opinions we do not in any way imply that they are the only ones or even that they are the best for everyone. They are what we have found to be best for us." In all there are seventy-nine articles by various staff members. The work is 1,014 pages long, has 784 illustrations on 509 figures, references at chapter endings, and a subject and an author index. It is published by W. B. Saunders Co. $15.00.

"Surgery of the Stomach and Duodenum" (A Handbook of Operative Surgery), by Claude E. Welch, M.D., is illustrated by Muriel McLatchie Miller. The most common and important operations that are performed on the stomach and duodenum have been selected for discussion. We note in the Preface that the book is planned as a practical guide, particularly for younger surgeons (some of the older surgeons might well spend some time reading here and there between its covers). It contains 349 pages, seventy-nine illustrations, a Bibliography and an index. It is all very well done. It is put out by the Year Book Publishers, Inc. $8.50.

"Micro-arteriography and Other Radiological Techniques Employed in Biological Research," by Alfred E. Barclay, M.D., Honorary Radiologist to the Nuffield Institute for Medical Research, Oxford, contains 102 pages, forty-six figures, references and an index. Charles C Thomas is the publisher. $6.75.

"An Atlas of Normal Radiographic Anatomy," by Isadore Meschan, M.D., with the assistance of R. Farrer-Meschan, M.B., is both a textbook for students and an excellent work for those working toward specialization in roentgenology. In fact, it is a work that should be in the library of every roentgenologist. This book is 593 pages long, has 362 figures and an ample index. W. B. Saunders Co. is the publisher. $15.00.

"Surgical Care—A Practical Guide" is by Robert Elman, M.D. We wish we could quote the Preface in full. Although this work emphasizes the practical approach, physiologic principles have been constantly stressed. We read that the human mind tends to prefer the traditional, the tried and true, and the time tested, rather than the scientifically tested. This book seeks to outline a positive program of surgical convalescence or care that differs considerably from the traditional policy of letting nature take its course. It is based on sound physiologic and biochemical knowledge of what the body can and cannot itself accomplish. This is a work which deserves an outline of its contents: Historical Survey, Surgical Risk, Influence of Age, Systemic Reaction to Trauma, Psychogenic Factors in Surgery, Nutrition in Surgery, Physical Factors in Surgery, Basic Preoperative Care, Anesthesia, Inhalation Therapy and Resuscitation (Meyer Saklad), Routine Postoperative Care, Chemotherapy in Surgery, Postoperative Pain, Pulmonary Complications, Thromboembolic Disease, Postoperative Renal Dysfunction, Surgical Shock, Wound Complications, Abdominal Complications, Postoperative Fever and Thermal Burns. It contains 586 pages, is illustrated, has

(*continued on page 48*)

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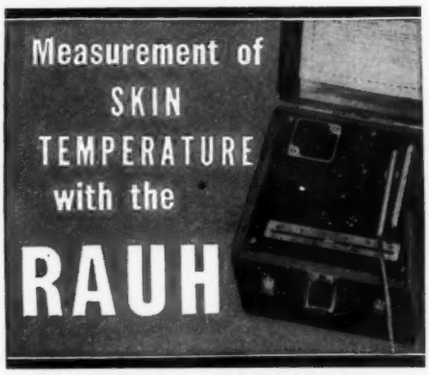

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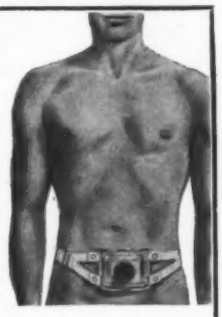

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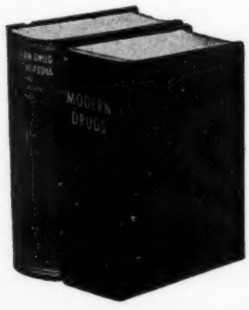

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Outside the Ivory Tower

(*continued from page 46*)

a Bibliography at chapter endings, an author and a subject index. It is put out by Appleton-Century-Crofts, Inc.

The Macmillan Company has put out "Tonsil and Allied Problems" by Roy H. Parkinson, M.D. The fundamental sciences of anatomy, histology, embryology and physiology pertaining to the tonsil have been carefully reviewed. An attempt (and successfully) has been made to consider diseases of the tonsils not only from the point which concerns local clinical conditions, but also from the standpoint of general medicine. The busy practitioner will find this work a convenient and adequate source of information and one which is sure to prove invaluable to him in his every day work. It contains 432 pages, 250 figures (some in color), fifty-two references and an index. It is a beautifully done book. $12.00.

"Atlas of Genitourinary Surgery" is by Philip R. Roen, M.D. and has an Introduction by Clarence C. Bandler, M.D. The many illustrations were done by Charles Stern. The author lives up to the aim of the book to present simple line drawings of the step by step progression of operative procedures without long, involved and unnecessary explanations. All the standard procedures and the newer technics introduced within recent years are included. It contains 325 pages and has an index. The publishers are Appleton-Century-Crofts, Inc.

Charles C Thomas offers us "Surgery of Peripheral Nerves" by Emil Seletz, M.D. The Art Editor of this publication is Tom Jones. We quote from the author's introduction: "In civilian practice there is rarely adequate material available to any one man or any group of men for extensive study of peripheral nerve problems. . . . Thanks to the excellent policy of the Surgeon General's Office and the persistent and untiring interest of R. G. Spurling and Barnes Woodhall it has been possible to repair and follow up the vast number of cases of nerve injuries which were incurred in World War II to complete recovery . . . Many important principles were learned . . . We personally observed, repaired and followed the progress of 2,037 peripheral nerve injuries . . . On analyzing our fortunate results we decided that they were largely due to the new and original variations in technic developed in our service." The text is simple and to the point. The incorrect and correct are stressed. The illustrations (136 figures, often several drawings to a figure) are above average. There are 185 pages and an index. Any surgeon who does this work or who may be called upon to do this work, would do well to read the text carefully and to study and observe the illustrations. $10.75.

JOHN D. Cash, vice-president of Wyeth, Inc., sponsors of the Gorgas Medal award established in 1942, presented the 1951 Medal to Rear Admiral Charles S. Stephenson, USN retired. The presentation was made at the Association of Military Surgeons of the United States annual meeting at the Palmer House, Chicago, October 9th. Admiral Stephenson also received a cash award of $500 which accompanied the Gorgas Medal. He was honored for his contributions to the health and welfare of the U. S. military forces as chairman of the Typhus Commission during World War II.

AS part of a widespread campaign to publicize the unique qualities and benefits of American medicine, Eli Lilly and Company is featuring a "Medicine in America" series of paintings in its bimonthly house organ, *Physician's Bulletin*, through the year 1952. Six scenes have been chosen to illustrate representative aspects of America's unique patient-physician relationship. These will appear as a cover-flap in each issue and may be torn out and displayed in physicians' waiting rooms. The important message the paintings tell will thus have the attention of those who will have great influence on the form in which medicine in America will be practiced.

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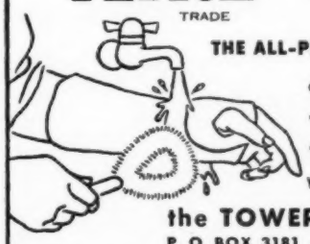

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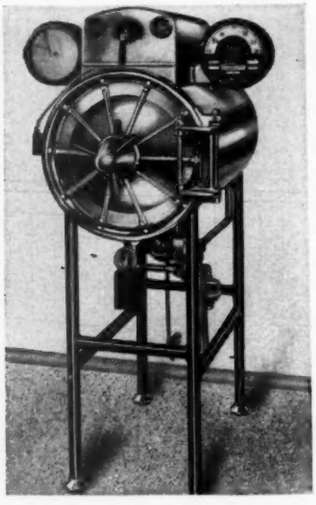

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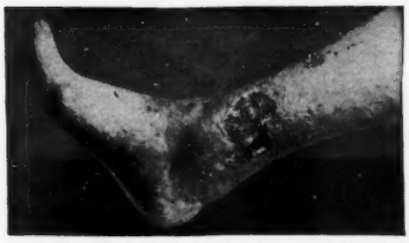

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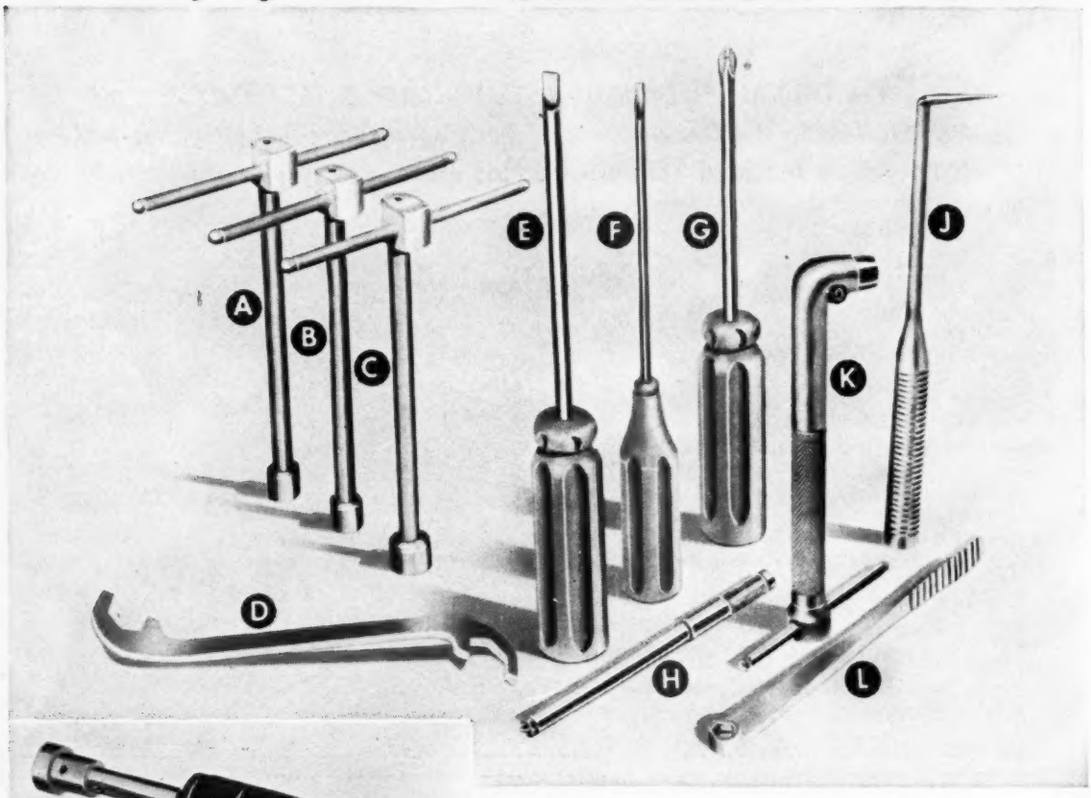

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1. Roedy, W. J.: J. of Lab. & Clin. Med. 37:385 (March) 1951.

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